AUGUST 1979

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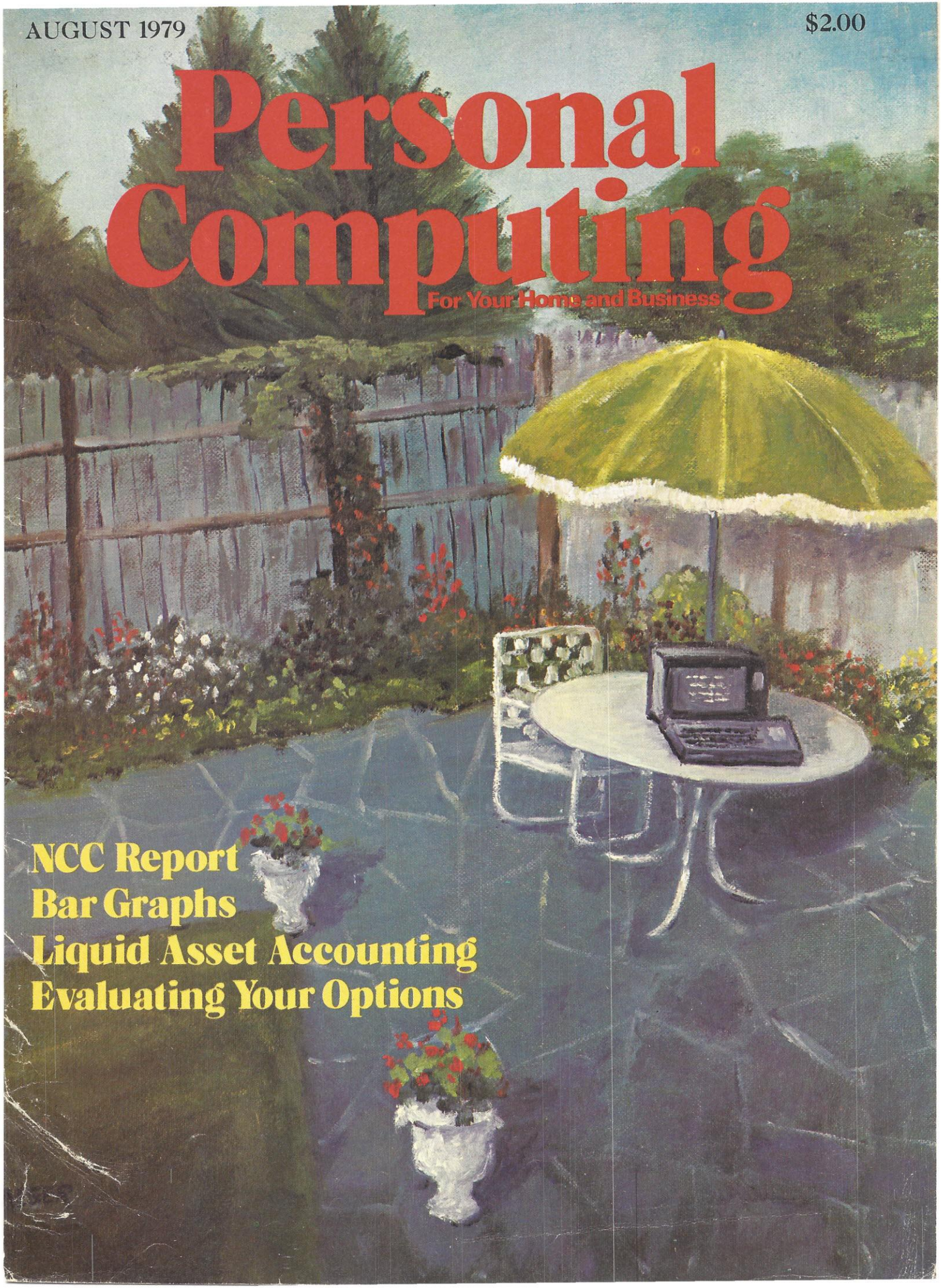
Personal Computing

For Your Home and Business



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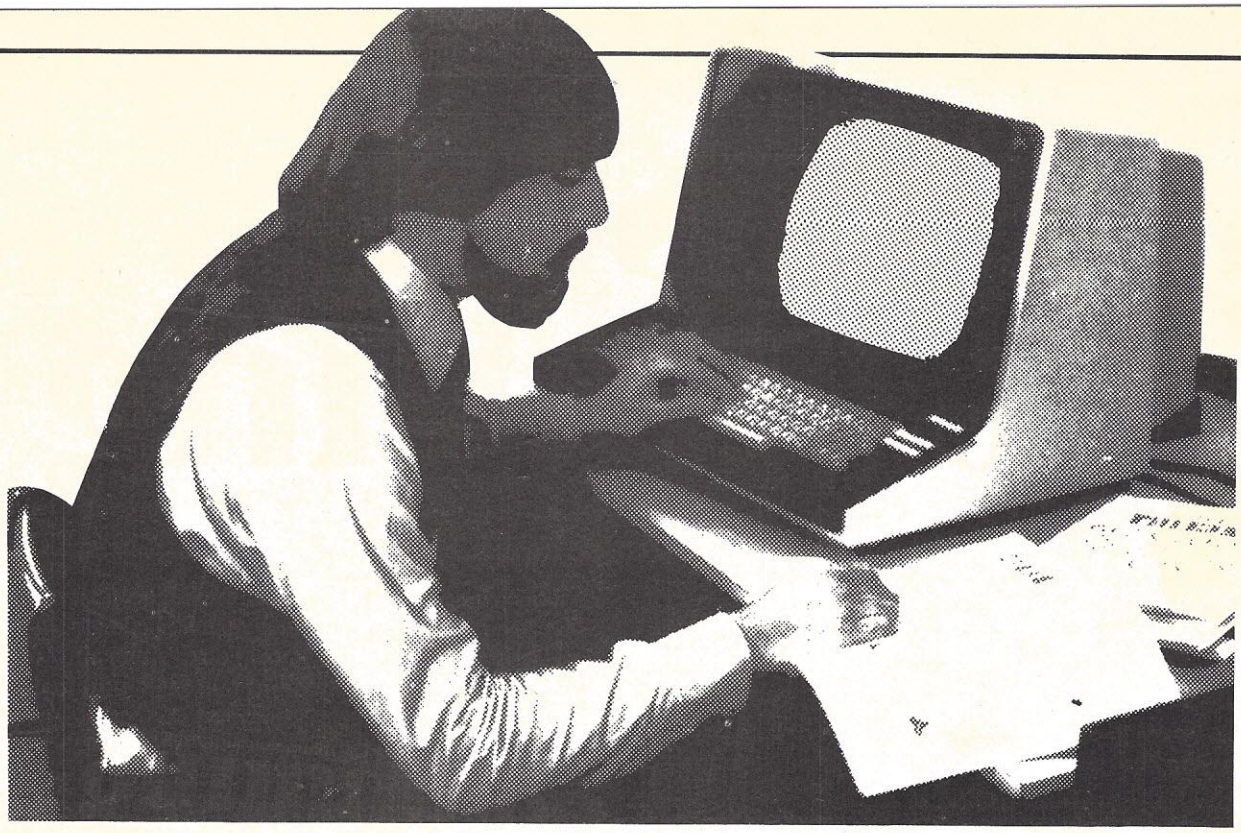

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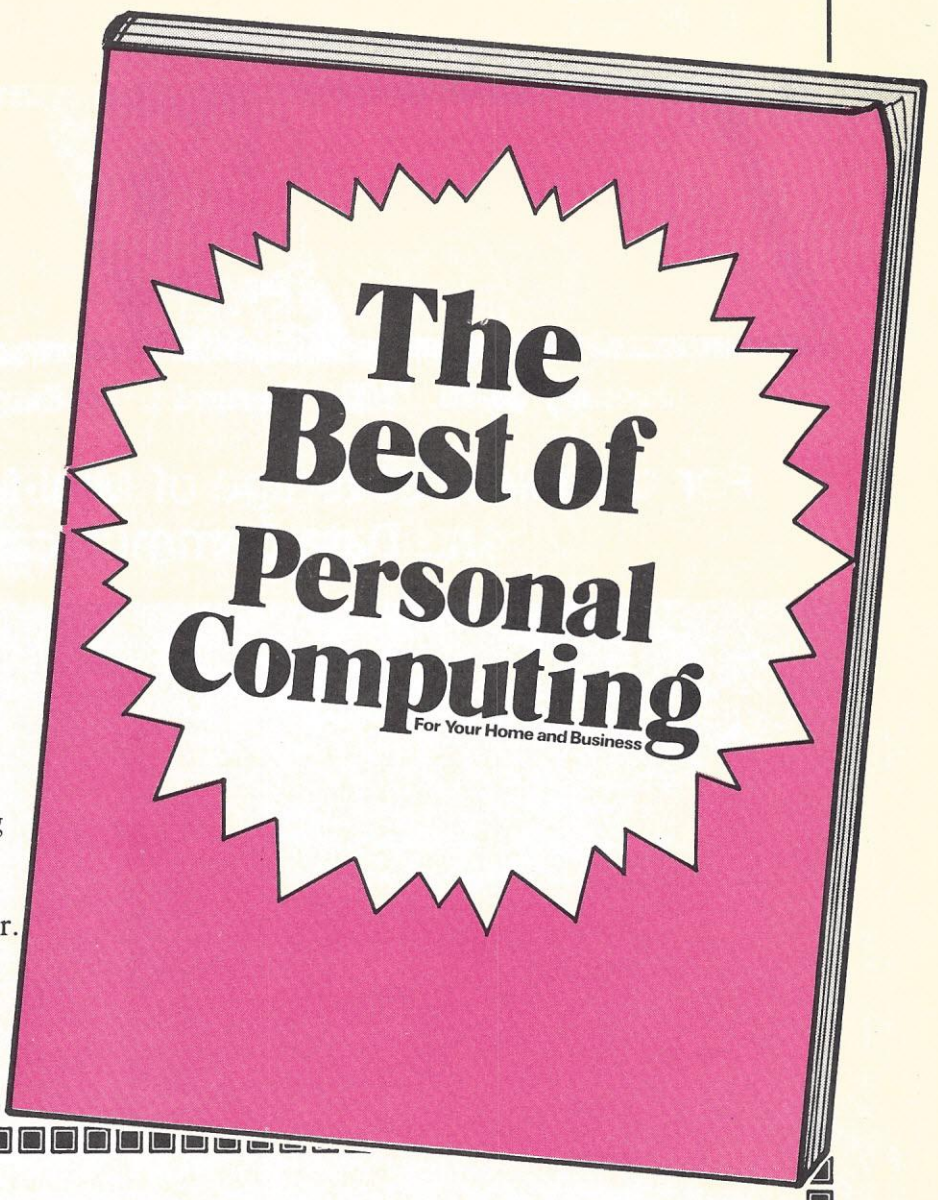

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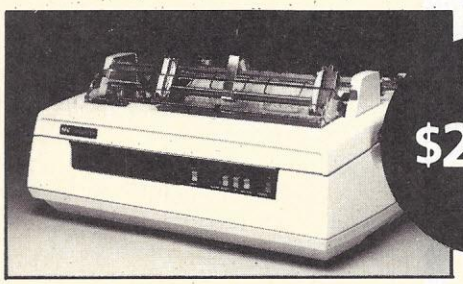

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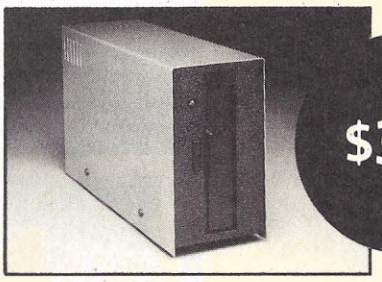

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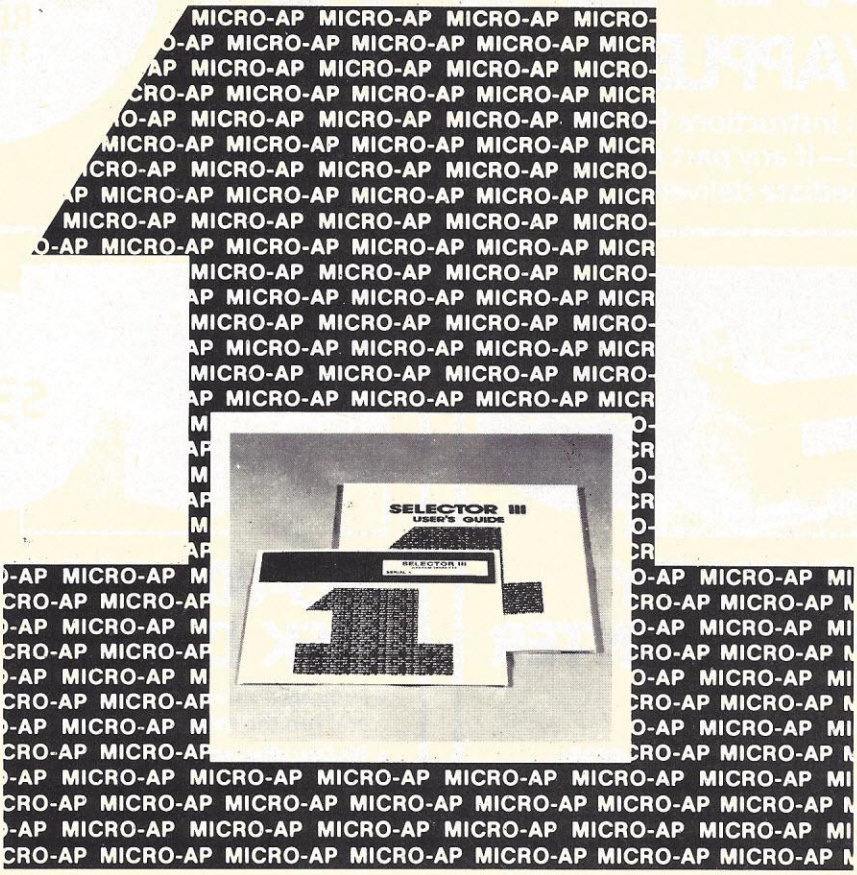

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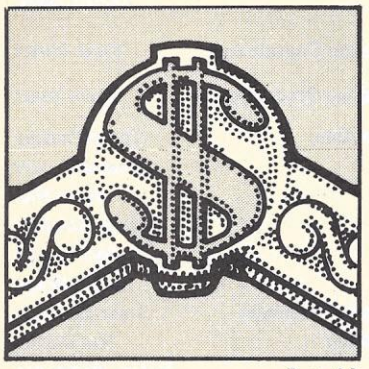
CIRCLE 6

AUGUST 1979 Vol. III No. 8

Personal Computing

For Your Home and Business

Page 28



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Page 50

DEPARTMENTS

LAUNCHING PAD

DIGGING IN

ON THE LIGHTER SIDE

Our cover artist, Murray Yaeger, is a professor of broadcasting at Boston University's School of Public Communication. He paints as a hobby in Kennebunkport, Maine. This month's cover is a representation of the patio behind his house. Yaeger also painted our September 1978 cover, which showed a barn sale of antiques — including an "antique" CRT.

Publication Number USPS 370-770

Personal Computing

AUGUST 1979 Vol. III, No. 8

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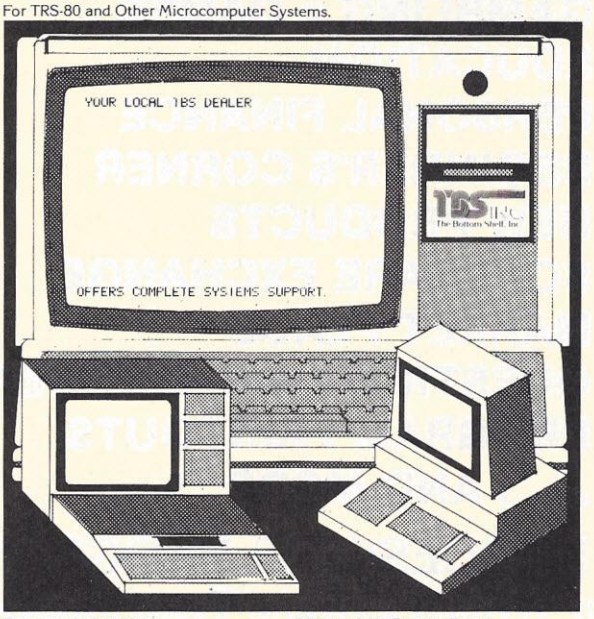

Computers of the Past
Computers of the Present
Computers of the Future
Methods to Program Your System
Software Background Report
Preparation for Programming
Standards for Professional Programming
Security of Business Data and Programming
Purchase, Care and Maintenance of the Business Computer
Review of the Electric Pencil
The Diskette Revolution
The TRS-80 and the Business Community
Computer Aided Instruction
The Microcomputer and the Wall Socket
Level II Index
Random Ramblings

A camera is useless without film; a typewriter is useless without paper; a computer system is useless without the necessary support to make it completely operational. TBS is leading the way in systems support, and we are proud to announce a new concept for the microcomputer industry - **FULL SYSTEMS SUPPORT**. Mainframe and minicomputer industries have been following this concept for years. However, until now it has not been available for microcomputer systems. TBS Full Systems Support is aimed at helping you, the computer owner, acquire the necessary support items quickly and inexpensively through a network of affiliate dealers nationwide.

We also realize that there is limited material available on computers in general. To fill these needs we have produced **SYSTEMS EXTENSIONS**. This is a unique publication which provides a theoretical computer background for the novice computer user and some specific points of programming interest for TRS-80 users. Seventeen articles are included in 63 pages of solid text.

But even more important, **SYSTEMS EXTENSIONS** provides a source of supply for a series of products applicable to all computers. Through this publication TBS and its affiliate dealers offer over 300 items including software, diskettes, cassettes, printer supplies, storage units and furniture. In other words, TBS and its dealers stock everything to make the microcomputer a full scale business system.

At the heart of your computer system is the software. We now offer the following programs for the TRS-80: **TBS Business Mail System** for dual disk and printer; **Check Register Accounting System** for dual disk and printer; **Basic Toolkit**, a programmers aid; **System Doctor**, a computer diagnostic program; **Checkbook II**, cassette based personal finance; **Information System**, an "in-mem" data base manager; **Analysis Pad**; a columnar calculator; **Terminal Control**, for RS-232 tele-communications; **Exerciser**, for establishing physical fitness goals and regimens; plus, **Electric Pencil**; **Fortran** by Microsoft; **NEWDOS+**; and of course, the **Library 100**. Details in full are included in **SYSTEMS EXTENSIONS**.

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CIRCLE 10

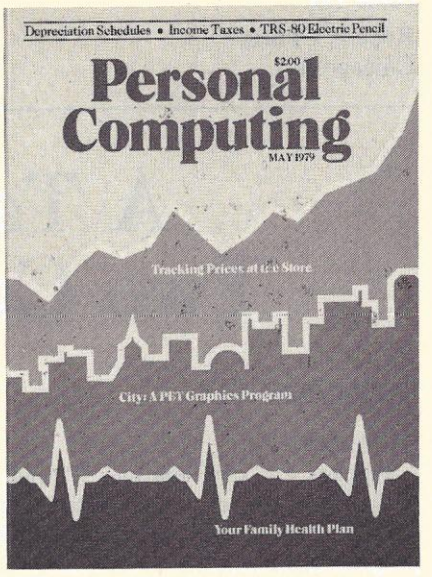
City for the TRS-80

Dear Editor:

I always enjoy your magazine and so, this is my first letter/program to an editor. The article "City" (May 1979) got me interested in making a copy for the TRS-80. Here is a program for L1-L2 in 934 bytes. It fills the screen in 5 to 7 minutes and the speed is pleasing. I let this one run for hours as a "decorative" graphic. I hope you can use it.

Robert A. McDaniel
Brooklyn, NY

Editor's note: See Figure below for Mr. McDaniels's program listing.




```
10 CLS
11    '* CITY *
12    'ORIGINAL (FOR PET) IN MAY, 1979, PERSONAL COMPUTING
13    'RE-DESIGNED FOR TRS-80 BY ROBERT MCDANIEL
14    'L1 & L2 - 934 BYTES
30 X=60:Y=22
40 D=RND(4)
50 GOTO 210      'DIRECTION
60 GOSUB 410     'GRFX BLK
70 D=0:GOTO 40
210 ON D GOTO 225, 245, 265, 285      'UP-RIGHT-DOWN-LEFT
225 Y=Y-2:GOSUB 300:GOTO 60
245 X=X+4:GOSUB 300:GOTO 60
265 Y=Y+2:GOSUB 300:GOTO 60
285 X=X-4:GOSUB 300:GOTO 60
300   'WRAPAROUND
310 IF X<0 THEN X=X+128
320 IF X>127 THEN X=X-128
330 IF Y<0 THEN Y=Y+48
340 IF Y>47 THEN Y=Y-48
350 RETURN
410 ON D GOTO 425, 445, 465, 485      'TOP-RIGHT-BOTTOM-LEFT
425 SET(X,Y):SET(X+1,Y):SET(X+2,Y):SET(X+3,Y)
430 RESET(X,Y+1):RESET(X+1,Y+1):RESET(X+2,Y+1):RESET(X+3,Y+1)
435 RETURN
445 RESET(X,Y):RESET(X+1,Y):SET(X+2,Y):SET(X+3,Y)
450 RESET(X,Y+1):RESET(X+1,Y+1):SET(X+2,Y+1):SET(X+3,Y+1)
455 RETURN
465 RESET(X,Y):RESET(X+1,Y):RESET(X+2,Y):RESET(X+3,Y)
470 SET(X,Y+1):SET(X+1,Y+1):SET(X+2,Y+1):SET(X+3,Y+1)
475 RETURN
485 SET(X,Y):SET(X+1,Y):RESET(X+2,Y):RESET(X+3,Y)
490 SET(X,Y+1):SET(X+1,Y+1):RESET(X+2,Y+1):RESET(X+3,Y+1)
495 RETURN
```

Dear Sir:

Indeed "City" must be run on a PET computer because it uses special graphics and cursor functions, but "City-80" is a simple modification away!

Mr. Olson's program is easily converted for use on a TRS-80 by replacing the quotes and enclosed symbols as indicated by the following list:

"↓" .....CHR$(26)
"→" .....CHR$(25)
"←" .....CHR$(24)
"■" .....CHR$(176)
"R■R" .....CHR$(131)
"R◧R" .....CHR$(170)
"◧" .....CHR$(149)
"↑" .....CHR$(27)

In addition, the following line replacements are useful:

```
10 CLS: PRINT STRING$(24,CHR$(
 26));   STRING$(32,CHR$(25));
15 L=24
100 D=RND(4)
1010 IF L=47 THEN 1040
```

The program requires Level II but little memory.

Mac Crews
Hattiesburg, MS

What Is Computer Science?

Dear Editor:

I must reply to the really strange opinion of what is Computer Science contained in the reply of "H.S." to Lou Mitchell's letter (*PC*, May 1979). H.S. has Computer Science, computer technology and Electrical Engineering all mixed up. He also displays a confusion as to what's going on inside the circuitry.

First of all, Computer Science is roughly the study of algorithms, languages, systems and their theoretical underpinnings. It is much closer to math and logic than to engineering. The whys and wherefores of what goes on in the circuitry is the concern of the Electrical Engineers. Although the structure

of the computer on the large scale (registers, buses, memories — the "architecture") is of concern to Computer Scientists, they usually let the Electrical Engineers worry about the details at the circuitry level.

If Mr. Mitchell were to open a good book on Computer Science, chances are pretty good that he'd get well past page 2 before getting bogged down. Furthermore, he would find very little detail on Electrical Engineering and Computer Circuits. There are dozens of excellent books on Computer Circuits. There are dozens of excellent books on Computer Science. To get deeply in, one must have a strong math background but even without that, there are many good books. A few I could recommend are: *Computer Science: A First Course* by Forsythe and others (Wiley); *Software Tools* by Kernighan and Plauger (McGraw-Hill); *Algorithms + Data Structures = Programs* by Wirth (Prentice-Hall). For those who would like a general overview there are two good books: *Computers, Their Structure, Use and Influence* by Slotnick and Slotnick (Prentice-Hall) and *Minicomputer Systems* by Weitzman (Prentice-Hall). For the determined student, there is the very mathematical, three-volume *The Art of Computer Programming* by Don Knuth (Addison-Wesley). Unfortunately, all but the Kernighan and Plauger are fairly expensive hardbound books, so try the local library.

There is no reason that a determined person with at least a high school education could not learn how a computer works. Just as you don't have to be an automotive engineer to understand the internal combustion engine, you don't have to be a computer engineer to understand how a computer works.

R.L. Wexelblat, Ph.D.
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Readers Write About May

Electric Pencil article was good. Also liked Tax Base and Depreciation.

James H. Wright
Madison, TN

Super article on Depreciation and Income Tax.

Robert C. Pulak
Chicago, IL

Tax Base was good. Why not more articles featuring Pascal?

Dr. Richard Yensen
Baltimore, MD

A Tale of Two Companies

Software-80

Gentlemen:

Perhaps you can help me. We purchased from one of your advertisers in the May issue (page 67), a Software 80 program as follows:

1	1038	Accounts Receivable	$99.95
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1	1045	Invoicing	99.95

It was not as represented. In discussing the program with a gentleman on the telephone, it was suggested that I purchase the three programs and try them out and he would then tailor them to my needs.

However, when I returned to the company the licensing agreement for the programs, it was returned by the Post Office marked "Moved — left no address".

When trying to contact them by phone, I found it was disconnected.

Would you be able to put me in touch with any of the Software 80 people; or, if they sold their programs to dealers and distributors, would you forward their names and addresses?

The Company in question is: Software 80, 18228 Cabrillo Court, Fountain Valley, CA, 92708.

Let us hear from you soon. Thank you.

Warren R. Jones

Editor's Note: You're not alone, Mr. Jones. Several other readers have also had trouble contacting Software 80. In fact, we can't locate them ourselves — we run into the same roadblocks you do. Apparently, the company has gone out of business.

We're contacting authorities concerning the matter. In the meantime, we caution our readers against responding to Software 80's ads which ran in previous issues.

By the way, we would have responded to your letter personally — as well as here in the Feedback column — except we didn't have your address. Our mailroom handles a large volume each day, and letters often become separated from envelopes before they reach an editor's desk. So when you and other readers write in — and we encourage your feedback — please include your address and phone number on the letter as well as the envelope. —*D.W.*

World Power Systems

Editor's note: World Power Systems executives Norman Henry Hunt and Dinah T. Robinson are in custody and awaiting trial in Federal court, according to Rex Angeley of the Pima County Attorney's Office in Tucson, AZ.

Hunt and Robinson, who posed as the husband and wife team of James and Lee Anderson, were involved in the bogus mail order company, which operated out of Tucson. Federal officials called the scheme a "double bust out". World Power Systems sent out financial data to suppliers and placed ads to consumers. Equipment was bought on credit and cash orders were taken from customers. WPS never paid the suppliers, and sent out only enough equipment to try to appear legitimate, according to the Pima County Attorney's Office.

World Power Systems advertised with a six-page insert in the June issue of *PC*. Readers are warned not to order from this company. For more details on the case, see our Editor's Memo in the July *PC*. —*M.M.*

Artificial Intelligence

Editor:

I would like to echo the letter from Mr. Bill Vick in the May 1979 issue of *Personal Computing* concerning your over-emphasis of chess playing programs in your publication. I hope this emphasis will diminish in the future as your magazine seeks to advance the state of personal computing.

I feel the current state of personal computing could be still in the area of a "fad", primarily for "computer scientists", but the future lies in the ability to provide services for the "masses". Four or five yars ago when microcomputers became available, it was primarily for the electronic engineer and the early publications were for the hardware-oriented population. We now find ourselves on a threshold of large advances in providing accessibility of this technology for a large proportion of non-computer individuals. Costs are decreasing and, as many of your articles discuss, programs can be written to help in many areas of businss and personal concerns.

Your response to Mr. Vick's letter states that computer chess is a scientific research into artificial intelligence and, as such, it can lead to great discoveries in this area. Scientifically speaking, you are correct: but how many people are involved in the study of artifical intelligence? I would propose the majority of your current and future readership will be in the area of commercial and personal uses of computing for business applications, and it is this area I feel you should stress throughout your publication. If publications still paid the majority of attention to the hardware aspects as they did in the beginning of our industry, we would still be an extremely limited industry. We have now evolved to the point that personal computing is (or can be) used in many day-to-day applications and be economically justified for many businesses, but microcomputers are still primarily toys for the programmers. The next major advance will be to provide the mechanism to advance personal computing into the area of availability for the end users. This advance can be enhanced through magazine articles designed to educate everyone and provide a communication medium for systems and applications designed for end user needs.

Keep up the good work in the area I have discussed above, but please, for the benefit of the majority, don't expend all the emphasis on the limited field of artificial intelligence.

Mel McElroy
Bellevue, WA

To the Editor:

H.S. (Senior) in his reply to Bill Vick lets loose with: "this ancient board game represents the most popular challenge to human intelligence that man has ever devised. . ." I take offense to that. The game of billiards or/and pocket billiards represents more of a challenge to human intelligence than does the stagnant pastime of chess.

How do I know this? H. S. reveals it in his sentence: "And computer chess has the added promise of revealing, someday, how to duplicate the mechanisms of human intelligence itself."

Well, if the game is so challenging to us humans, how come a computer can duplicate it? I've yet to see a computer that can figure out the geometric complexities of the physics of billiards or pool. Eh wot, H.S.?

H.T. White
Osceola, WI

Typewriter/Printer

Dear Editors:

An idea came to me the other day but I don't know if it would work.

Olivetti makes an electric element-type typewriter, the Lexicon 82. Since an IBM Selectric can be modified for use as a printer on a computer, couldn't the Lexicon 82 also be modified? I realize that they differ in structure (the Lexicon 82 has a moving carriage while the Selectric has an element mount).

At times I've seen an electric typewriter modified to work as a makeshift input terminal. It was used until the regular terminal was repaired. I want to attach the typewriter to a TRS-80.

What do you think? Can it be done?

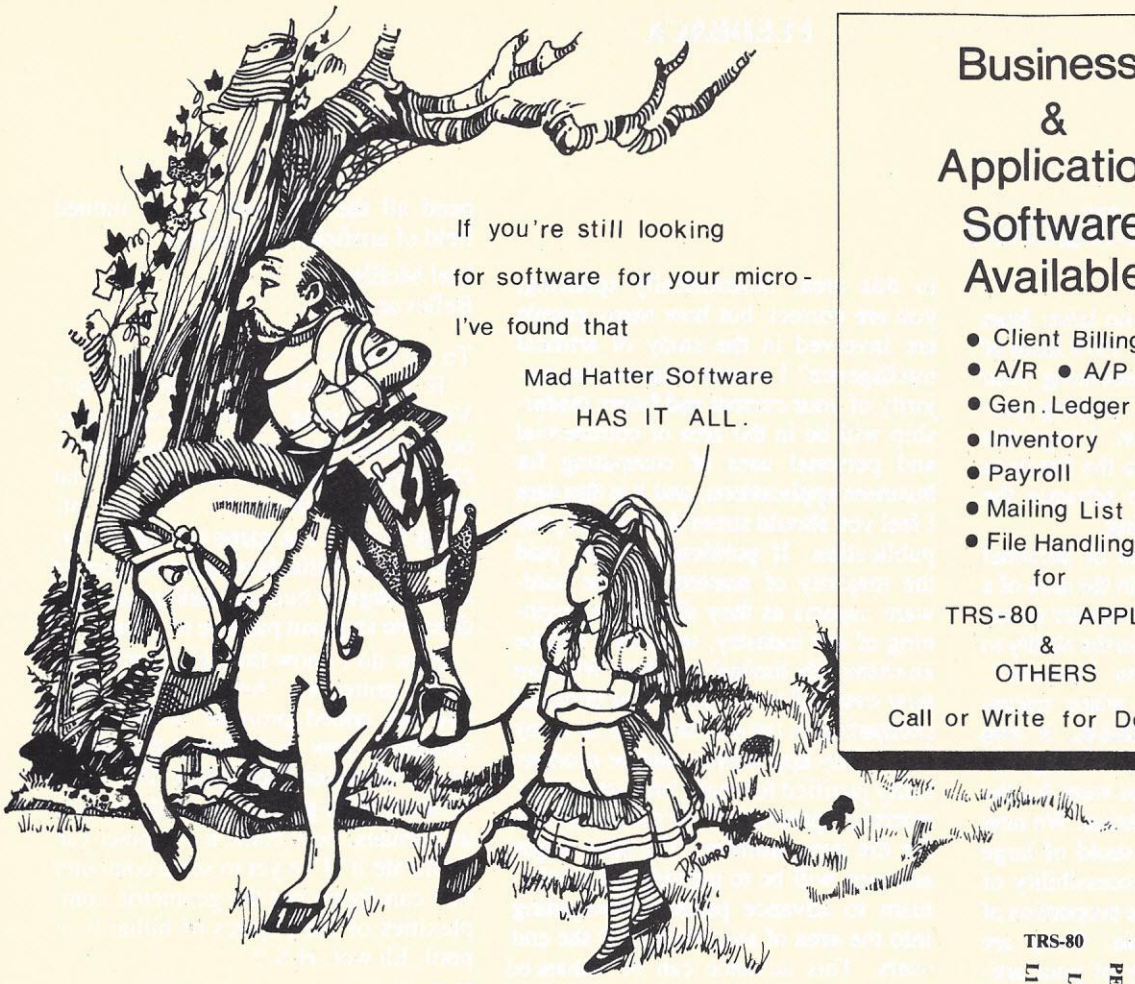
Devin Smith
121 West Goodman Drive
Fairborn, OH 45324

Editor's note: Anyone with an answer to Mr. Smith's problem can write him directly. Send a copy of your letter to *Personal Computing*, 1050 Commonwealth Ave., Boston, MA 02215 and we'll publish the most helpful and interesting solutions. —*M.M.*

Cut That Out!

Editor's note: In our article "Planned Programming: The Thoughts Behind the Structure" (June 1979) line 1510 on page 34 is printed incorrectly. Below is the corrected printout. —*M.M.*

```
1470 REM       PRINT SCALE FOR BAR GRAPH:
1480 REM
1490 PRINT TAB(10);B;TAB(30);B+2*12;TAB(50);B+4*12
1500 PRINT TAB(20);B+12;TAB(40);B+3*12;TAB(60);B+5*12
1510 PRINT TAB(12);"'         '         '         '         '    ."
1520 REM
1530 REM       FOR EACH DATA ITEM, PRINT LABEL, VALUE, AND BAR:
1540 REM
1550 FOR I=1 TO C
1560   PRINT L$(I);TAB(12);
1570   LET J=(V(I)-B)/I1
1580   LET J=INT(J+.5)
1590   FOR K=1 TO J
1600     PRINT "*";
1610   NEXT K
1620   PRINT "*"
1630   PRINT V(I);TAB(12);
1640   FOR K=1 TO J
1650     PRINT "*";
1660   NEXT K
1670   PRINT "*"
1680   PRINT TAB(12);
1690   FOR K=1 TO J
1700     PRINT "*";
1710   NEXT K
1720   PRINT "*"
1730   PRINT
1740 NEXT I
1750 END
```



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CIRCLE 11

Science Fiction Writer Discusses Future of Computers

When science fiction writer David Gerrold was asked to name the future development he believes will have the most impact on society, he answers without hesitation, "Home computers."

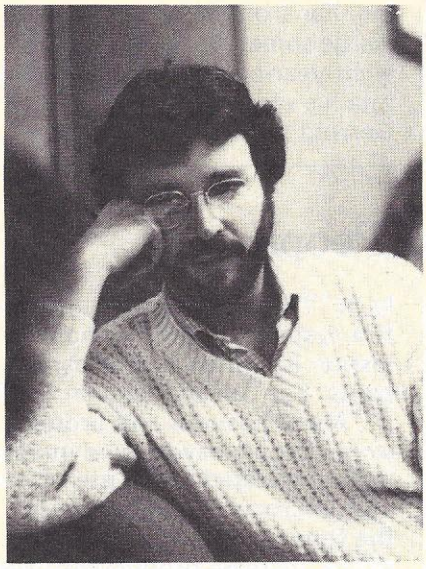
Said Gerrold, "We're growing into the technology slowly, but by 1984 the home computer will be the most important new appliance in the market. By the end of the decade, it will be as common as television."

Gerrold, who has been writing science fiction since 1967 when he scripted the popular *Star Trek* episode, "The Trouble with Tribbles", did research on computers for his 1972 novel, *When Harlie Was One. Harlie,* which was nominated for Hugo and Nebula awards, told the story of the "ultimate" computer. Gerrold has written numerous other science fiction novels, stories and TV scripts, and a sequal to *Harlie* is planned.

In a recent interview, Gerrold spoke at length about the future possibilities of home computers and his own involvement in personal computing.

He believes several factors will spur consumer demand for home computers in the near future "The first really big demand will occur when people who have learned programming in school will say, 'I want a computer in my house.' When that starts, probably in about five years, they'll buy a computer before they buy a stereo system."

Right now, Gerrold said, the complexity of computers frightens many people who are not knowledgeable about them, while those who are often find current systems either too simple or too expensive. "A current $600 computer might leave a knowledgeable user frustrated because it can't do enough, yet most people won't pay $4000 or $5000 for a complete system," he said.



"Automobiles did not become a big consumer item until Henry Ford built the Model T," Gerrold noted. "What we need now is the people's 'Volks' or Model T home computer.

"The one that will take over the market is the one that is smarter than the consumer. It will say, 'What do you want me to do?' Then it will print out a set of programs in response to the answer. That will be the people's 'Volks' computer."

Gerrold believes the computer will become the most important item in the house within a decade. "It will be used to integrate all the other appliances into one system," he said, "controlling the stereo, smoke detector, video tape recorder, vacuum cleaner and so on."

Looking a bit further into the future, he sees other technological developments which will speed the home computer revolution. "The next big step will be when the telephone company provides computer hookups via the home phone. Big screen TV will also be important. I think once people have big screen sets, they will want to use them for something besides just TV. Of course all of this is a large extrapolation, and a major change in technology could make things happen differently."

When the home computer revolution comes, Gerrold says he'll be ready. "I have a system on order now," he said. "I held off getting one for some time because people were telling me Apple or Compucolor were too limited for what I wanted to do. So, I decided I would have to get heavily into it.

"I'm doing it very much the way I put together a Hi-Fi system ten years ago. What I did then was buy all the Hi-Fi magazines and read them religiously for a year before I bought anything. Then I went to the Hi-Fi shows, and finally I bought a turntable, receiver and two speakers. Later on, I added to it, upgrading it piece by piece. Now I have what people who should know say is one of the ten best systems in L.A."

Gerrold plans to use his computer primarily as a word processor, something several other SF writers, including Jerry Pournelle, already do. "I want a big screen with color graphics, something in the $10,000 range," he said. "I have a friend who builds and programs computers searching out components for me.

"We've picked out a CRT with good graphics and color capability. We want a processor that can handle two, maybe three disk drives. We're going after stuff that will let us add new components later on. Then as new computers become available, I'll be ready."

Once home computers are commonplace, then the real changes will begin, Gerrold thinks. These include such things as books not only written on home computers, but also received and read on home computers; instant access to information via telephone linkups to other computers; home banking; a new advertising medium; and much more.

Many people still fear computers, Gerrold noted. For years,

science fiction writers have played on those fears to create malevolent, emotionless superbrains like Hal in *2001,* and Colossus in *The Forbin Project.* But even in his fiction, Gerrold views computers as useful tools of tremendous potential.

Although Harlie, Gerrold's fictional computer, wants to become God (a G.O.D. — Graphic Omniscient Device), he is portrayed as likeable and well meaning. Far from being emotionless, Harlie sometimes acts like the eight-year-old he actually is, despite his vast intelligence. But Gerrold's positive attitude toward technology and computers permeates the book.

Gerrold sees computers as not only useful, but necessary. "Every other machine man has ever built has been to amplify human muscles," he said. "The computer is the only one that amplifies intelligence." *— by Allan Maurer*

Seminars for Business People

Business people and professionals looking for computer systems and secretaries wanting word processing skills can get some help through two available seminars.

Monoson Microsystems, Inc., of Watertown, MA, opened a showroom and training center for small business and word processing systems. "We specialize in putting together systems for the office, tailored to the current and projected needs of clients. We will be offering seminars and workshops so that people can learn how to benefit from these desk-top units," said Jack C. Star, president of the company.

Monoson Micro's first seminar, which will be repeated frequently, is "How to evaluate small office systems." This two-hour session is limited to five participants. Fee for the seminar is $7.

"Many business and professional people have grown increasingly interested in the use of low cost microcomputers to speed the flow of paper through the office, increase productivity and help managers make better decisions. To those people I suggest, 'think small'. If you have little or no experience with computers, start with a system in the price range of $125 to $175 a month, and grow from there," advised Star.

A workshop for secretaries, "Your career in word processing," will be given for three consecutive Tuesday evenings. "Word processing secretaries and department managers are in great demand, and that demand will skyrocket in the coming two years. Word processing will become one of the important career paths for secretaries and other office workers. For example, today a secretary with word processing skills can earn 20 to 50 percent more per week. For those with managerial skills, the opportunities are almost unlimited," said Star. Fee for the workshop is $25.

The showroom's hours are from 11 a.m. to 6 p.m., Tuesday through Thursday, with other hours by appointment. For more information contact Monoson Microsystems, Inc., 51 Main St., Watertown, MA 02172; (617) 924-2124.

Report from Munich: The German Home Computer Market

Although more than 7000 personal computers are in use in Germany, the systems' high cost and other problems have prevented the machines from becoming true home and hobby computers, reports Professor Klaus Jamin, a *PC* subscriber from Munich.

For example, an 8K PET costs $1600 while a 4K TRS-80 sells for $1000. So small companies, lawyers, accountants, doctors, dentists and schools account for about 80% of the German personal computers. (Munich alone has about a hundred computers in schools, Jamin noted.)

Of course, there *are* some hobbyists as well. One, Jamin reported, wrote a Morse Code program to receive and send signals all over the world. But he ran into problems with the German Bundespost (telegraph company) monopoly, which doesn't allow use of computers in this field.

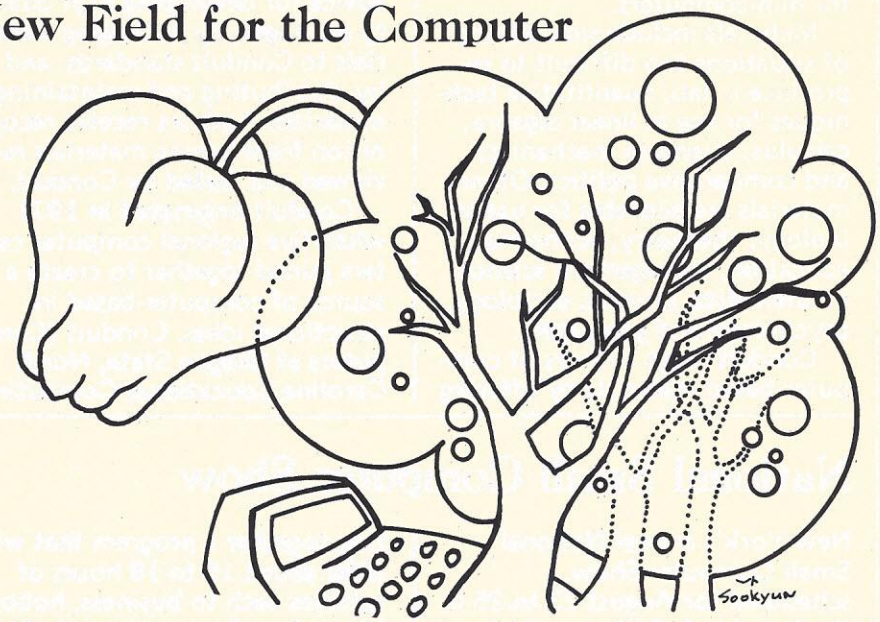
Also, hobby computer clubs exchange programs written by members; and games software — including some not available in the U.S. — is sold in Germany.

Just like their American cousins, German users face numerous problems. For example, Jamin said, it took two years for engineers to adapt the PET to run on German house current. Also, there are no domestic German personal computers. The only ones on the market are expensive American imports such as Radio Shack, Mits, Apple, Imsai and Commodore.

Other problems in Germany sound all too familiar to American ears. There aren't enough repair centers. ("If your system breaks down, there's no problem in big cities," Jamin said. "But in the country, you'd better forget your computer.") There's not enough peripheral equipment, such as PET disk drives, available. And equipment problems such as malfunctioning printer interfaces plague German users as much as they do Americans.

Professor Jamin would like to set up a letter and program exchange between American and German computerists. For more information write to Prof. Klaus Jamin, Nadistr. 24. 8 Munchen 40, West Germany.

Apple Orchards: A New Field for the Computer



Apple growers in the future, worried about crop damage, could be keeping a computer in the orchard to tell them whether the trees need chemical spraying, when to apply it and even what brand to use.

The computer was developed by a Michigan State University electrical engineer teamed with a botanist.

The microcomputer has been field tested for two years and may soon be turned over to commercial developers, said Dr. Alan L. Jones, MSU botanist who developed the device with Dr. P. David Fisher, associate professor of electrical engineering.

The researchers designed the computer — really a microprocessor — to control apple scab, a fungus common throughout the East and Midwest. Left untreated, scab can destroy an orchard's production for up to two years. To control it, farmers usually spray trees weekly, even when conditions are not right for a scab outbreak.

Fisher says the microprocessor may retail for under $1000, and growers could recoup the investment within two seasons by reducing use of costly fungicides.

Field tests on the microprocessor thus far have shown it virtually 100 percent successful in predicting the outbreak of scab, Jones said. More sophisticated versions of the device, able to adjust predictions on the basis of complex weather patterns, are under development.

Important as better scab control will be, another feature of the microprocessor is its flexibility, the researchers said. By changing its programming, "we should be able to monitor literally hundreds of pests," Fisher said.

The microprocessor predicts the likelihood of an apple scab infection, so a farmer can take preventive measures. Growers have known for years that scab occurs only under certain combinations of wetness and temperature. Also, the fungus can be destroyed only by spraying infected trees within eight hours of the outbreak. Traditionally, growers apply 10 to 15 fungicide applications a year to prevent scab on fruit and foliage.

The microprocessor continually monitors air temperature, relative humidity, the wetness of tree leaves, the time of day and the date. If the grower wants to know if an infection period is likely to occur, all he has to do is ask, using a typewriter keyboard. The microprocessor also informs the grower how many hours he has left to apply a fungicide and what kind of chemical would be most effective under existing conditions.

Jones estimates a grower could eliminate at least two or three applications of fungicide per season. In some years, applications could be reduced 75% or more.

After publishing a technical report on the microprocessor, Fisher received inquiries from throughout the world. Sheep growers in Australia wonder if the device could help prevent fungus damage to wool during the drying process; South African sugar refineries are interested in insect control with less reliance on pesticides.

Electronics firms in Canada, Switzerland and West Germany are also intrigued, Fisher said, and Utah scientists wrote looking for a better way to control potato blight.

Software for Education

Conduit, an organization dedicated to fulfilling the computer's potential as an aid in education, offers a service designed specifically for teachers interested in using computers for educational instruction.

The organization serves as a source of computer-based instructional materials that have been reviewed, well-documented, programmed for ease of transfer and kept up to date, according to organization officials. Anyone interested in the packages may order programs from Conduit.

Packages usually include a program written in BASIC or Fortran, a student manual explaining objectives and methods of use, an instructor' s guide illustrating course use and notes on installation of material. Although some cassette programs are available for microcomputers, most packages are offered on magnetic tape

for minicomputers.

Materials include simulations of situations too difficult to reproduce in lab; quantitative techniques for use in linear algebra; calculus; quantum mechanics; and comparative politics. Other materials are available for use in biology, chemistry, economics, education, management science, mathematics, physics, sociology, psychology and geography.

Conduit helps authors of computer-based materials by offering advice for developing high quality packages; by packaging materials to Conduit standards; and by distributing and maintaining materials. Authors receive recognition from having materials reviewed and tested by Conduit.

Conduit originated in 1971 when five regional computer centers joined together to create a source of computer-based instructional ideas. Conduit (Computers at Oregon State, North Carolina Educational Computing Service, Dartmouth College and the Universities of Iowa and Texas at Austin) was formed for the collection, evaluation and dissemination of computer-based instructional material.

Conduit's *Pipeline,* a publication issued three times a year, features ideas for use in higher education.

For more information contact James W. Johnson, Director, Conduit, P.O. Box 388, Iowa City, IA 52242; (319) 353-5789.

National Small Computer Show

New York's annual National Small Computer Show, scheduled for August 23 to 26 in the New York Coliseum, is aimed at users of micros and minis in the business office, professional field and home, according to Ralph Ianuzzi, show manager.

The show has scheduled approximately 46 hours of educational lectures over its four-day period, said Ianuzzi. "We're putting together a program that will offer about 15 to 18 hours of lectures each to business, hobbyists and professional people."

General topics to be presented cover programming, assessing office systems, selecting personal systems, household applications, artificial intelligence, marketing forecasting, various computer languages, simulations, educational applications in the home and school, word processing, investment analysis, mailing list management, computer art and expanding systems.

Show hours are: Thursday and Friday, Aug. 23 and 24, Noon to 7 p.m.; Saturday and Sunday, Aug. 25 and 26, 10 a.m. to 6 p.m. Admission is $5 per person, per day, by registration.

For more information contact National Small Computer Show, 261 Madison Ave., New York, NY 10016.

Computers Make the News

Newspapers all over the country are fighting to arrest a steadily declining share of national advertising — now down to an estimated five percent of total ad dollars spent last year — and a fall-off in circulation. They've chosen the computer to build a closer relationship with both advertisers and subscribers through increased efficiency and service.

"We've invested more money in the past three years than we have since our building was built and the presses installed at the Chicago Tribune," said Bill Wieck, director of administrative services for the 750,000-circulation daily. "Papers are suddenly investing money and are looking at new ways to meet and serve the information needs of the consumer," he said.

Many newspapers have completed a piece-by-piece computerization of their major functions from editorial preparation and control, through classified and display advertising, circulation control, to general business applications. What many are now looking for, said Conon Swann, a computer systems consultant with the Newspaper Printing Corp. of Nashville, TN, is the fully integrated newspaper system.

In this second phase of computerization, Swann predicted, much attention will be paid to the design concepts as well as the methods of implementation. The 1990 newspaper computer system, he suggested, will be built around a database that will have to accommodate more than the printed word. Newspapers by then will be communicating by additional means. They have the opportunity to be suppliers of information of all kinds to meet a growing consumer demand for accurate and convenient information in more and more areas: reference, instructional and entertainment material, as well as news.

Wieck and Swann agree that papers will be more demanding of vendors. There will be a contraction in the number of smaller vendors now supported by the industry.

The Newspaper Agency Corp., publishers of the Salt Lake Tribune and Desert News, is assessing its present computer system. Jerry Jennings, data processing manager, described the group's on-line circulation system as one of the "hot buttons" in the industry at the present time.

The two papers, a morning and evening, each have 1500 carriers and a combined circulation of 180,000. The carriers and subscribers are now mostly held in a database on a Honeywell 2040A computer system employing TOTAL database software — the files have been built over a period of more than two years and should be complete by June 1, said Jennings.

Twenty-nine display terminals in the circulation department are on-line to the computer and are used to handle all subscriber starts and stops, delivery routes and so on. "The ultimate goal is customer satisfaction. The computer system not only enables us to cope with a constant churning of carriers and subscribers, it is helping us to know our subscribers and our market area," said Jennings.

"The circulation department now says that they couldn't live without the system," he added.

The Newspaper Agency Corp. is looking to extend its computer system by installing a larger machine, as well as moving into new application areas such as a computerized newsroom system.

The Boston Globe's on-line library system, which uses display terminals to access information, has a database covering all the paper's news and feature stories going back to Oct. 12, 1976. It runs currently on the computer operated by the Mead Corp. in Dayton, OH, though plans are being made to bring it in-house.

"Within seconds we can literally recall 2-1/2 years of the Globe newspaper using the system. Every word, except 24 prepositions and articles, is searchable, because that's how reporters want it," said the Globe's librarian, George Collins.

Some 200 of the Globe's 300-plus editorial staff are now trained in the use of the system, which is already able to satisfy 70 to 75 percent of reporters' requests. When the database is rolled back to cover the past five years, Collins estimates that it will meet up to 90 percent of reporters' information demands. Ultimately, the nine million clippings in the Globe's library will be turned into microfiche for input to the computer database.

"These days the computer system is the key to putting the paper out," said Wieck.

Classroom Enthusiasm

While consumers have shown a positive, but cautious, interest in personal computers, educators and students are eager to reap the benefits offered by the new generation of small computers, reports Dr. Albert Yu, president of VideoBrain Computer Company.

Dr. Yu's conclusions are based on a VideoBrain program designed to test educational acceptance of personal computers. For the study, VideoBrain donated six computers to schools in California, then followed up to determine the reaction of teachers and students.

"Our initial study has convinced us that both educators and students are enthusiastic about having a computer in the classroom," says Dr. Yu. "Teachers have reported enthusiastic student acceptance of computers in educational programs."

In that study, youngsters were free to pick and choose among a variety of VideoBrain software that included both games and instructional material on preprogrammed cartridges. They often selected programs that allowed them to compete with each other or with the computer. Even after initial novelty wore off, teachers found groups as large as 10 gathered around the data display TV

screen while one or two students controlled the joysticks and keyed in questions and answers on the keyboard.

In another educational study, Yu noted that Schaak Electronics of Minneapolis, a VideoBrain dealer, and the Minneapolis Educational Consortium have made available to the public after-hours phoneline access of large computer data banks using the VideoBrain telephone coupler and access phone number. A wealth of information can be accessed by students, researchers or anyone with a home computer who, up to now, would have turned to an encyclopedia for data.

"It is tremendously exciting to foresee the potential of the home computer in education. Remote access of data banks means that up-to-date information can be at peoples' fingertips without the need to know a programming language," Yu said.

Software Survey Reveals Unhappy Users

Many users feel that application software is not up to par with the hardware in their small business computer systems, according to a recent survey published in the *Package Software Report,* a publication of Management Information Corporation. The worst areas, in the opinion of those surveyed, are documentation of the programs and vendor support.

This survey represents the computed, analyzed results of a mail survey of small business computer users conducted by MIC. The purpose of this survey is to determine how well software packages running on business micro or minicomputers are meeting the needs of users. There were over 500 responses to the questionnaire sent.

Other findings of this survey include:

- Over 50% of the respondees purchase program packages.
- No one company achieved a rating of 3.0 or greater in all categories, putting them in the "winners circle." This signifies a certain amount of dissatisfaction on the part of users.
- Although software is still mostly purchased, software rental is increasing.

For more information on this survey, priced at $10, contact Management Information Corporation, 140 Barclay Center, Cherry Hill, NJ 08034; (609) 428-1020.

☆☆☆ Announcements ☆☆☆

The Northeast Personal and Business Computer Show will be held at the Hynes Auditorium, Boston, MA, September 28 to 30. Show hours are: Friday and Saturday, 12:00 Noon to 10:00 p.m.; Sunday 12:00 Noon to 6:00 p.m. General admission is $5. For more information contact the Northeast Exposition, P.O. Box 678, Brookline Village, MA 02147; (617) 522-4467.

Apple II users in the Miami, FL, area have formed the Miami Apple Users Group to share software and technical information. The club plans to publish a newsletter. President is Steve Pierce. For more information contact David Hall, 2300 N.W. 135th St., Miami, FL 33167.

The Micrographic User Group sponsored by Houston Instrument has been formed for Hi Plot Digital Plotter and Hi Pad Digitizer users.

The group plans to cover computer graphics and provide a medium of exchange between its members. Areas of interest will include application experience, programming techniques, contributed software library, systems building and problem areas.

For more information contact Gabrielle C. Ryan, Micrographic Product Manager, Houston Instrument, One Houston Square, Austin, TX 78753; (512) 837-2820.

Computers in Psychiatry/Psychology (formerly *Micro-Psych*) is a bimonthly newsletter for professionals interested in using computers in psychiatry and clinical psychology. Each issue contains original articles, summaries and reviews of recently published articles and books, an ongoing bibliography and a program catalogue. Subscriptions to Volume #2 are $15. For more information, contact *Computers in Psychiatry/Psychology*, 26 Trumbull St., New Haven, CT 06511

The TRS-80 Club of Arlington, MA, is offering a free newsletter. For a copy, send a long, self-addressed stamped envelope and a $1 donation (not required) to TRS-80 Newsletter, 96 Dothan St., Arlington, MA 02174.

Heuristics, Inc., manufacturer of the Speechlab speech recognition unit for Apple and S-100 bus computers, announced the formation of a users group.

Interested Speechlab users should contact Tom Larson, Director of Sales, and send their hardware applications or software directly to Heuristics, Inc., 900 N. San Antonio Road, Los Altos, CA 94022; (415) 948-2542. A directory of users and applications will be published later, the group said.

The microCOMputer Club at College of the Mainland, TX, is sponsoring a Second Annual microCOMputer Faire scheduled for Saturday, September 8, 1979. Last year, said club officials, there were over 300 visitors for 30 exhibitions. This year, the club will be working with the University of Houston Computer Society toward a bigger and better show to be held at the Cullen College of Engineering at the University of Houston. At least 70 exhibitors are expected.

For more information contact Dr. John L. Hubisz, Div. of Natural Science & Math, College of the Mainland, Texas City, TX 77590; (713) 938-1211, ext. 244; or Dr. Nelson Marquina, Industrial Engineering Dept., University of Houston, Houston, TX 77004; (713) 749-2543.

The NW PET User's Group of Portland, Oregon, is looking for new members in the Oregon/Washington area. If you're interested, contact John F. Jones at NW PET User's Group, 2134 NE 45th Ave., Portland, OR 97213; (503) 281-4908.

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CIRCLE 4

RAM — A pro football player from Los Angeles. (There are two types of RAM: dynamic and static. Dynamic RAMs make many touchdowns. Static RAMs are unconscious.)

ROM — A popular Puerto Rican drink.

port — A type of wine, preferred by some programmers to ROM.

S-100 bus — A southbound Greyhound on Route 100.

8080 — Rotten vision.

Z-80 — A microprocessor chip, named for its inventor, Englebert 80.

8-bit machine — Your first estimate of the cost of a computer.

6800 machine — The actual price.

CPU — C3PO's mother.

MUX — Multiplexer, a device which plexes several different units simultaneously. (A device which plexes only one unit is a uniplexer, but is rarely encountered in modern equipment.)

monitor — A video terminal used for displayng computer data, as opposed to a video terminal used for displaying TV signals, called a merrimac.

A Mad Programmer's Dictionary

BY TOM MCDONOUGH

PRINT —Command used to tell the computer not to use longhand. (Such commands, when found at the end of very long programs, give rise to the common expression, "Some day your PRINTs will come.")

WRITE — An alternative to the PRINT command, this is used with computers with good handwriting.

computer — A complex electronic instrument, designed to allow humans to blame their mistakes on machines.

microcomputer — A metric unit of measurement, equal to one-millionth of a computer.

IF statement — Explanation by finance manager of what he will do to you if you miss your computer payments. Example:

```
100 IF PAYMENT=0 THEN 150
150 BREAK ARM
```

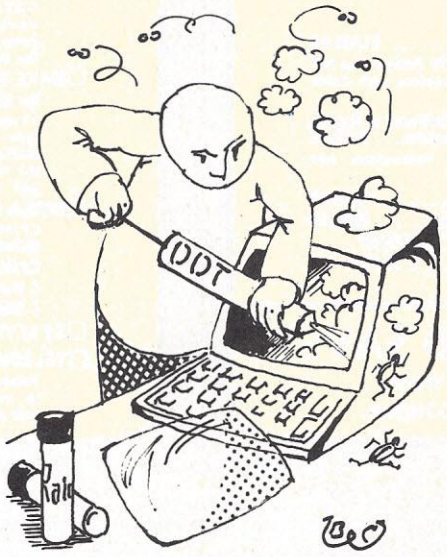
interpreter — A program that converts a high-level language like BASIC into a low-level language, like 8K PIGLATIN.

SYNTAX ERROR — Incorrect computation of three-martini-lunch deductions.

program listing — TV Guide.

bug — Something squishy, with legs, often found inside computers, or operating them.

debug — To spray Raid.



Sol 20 — The answer to "What did the home team do in the game against Altair?"

LED — Light Emitting Diode, i.e., one weighing less than three pounds. (HEDs, or Heavy Emitting Diodes, are used only on the biggest main-frame computers; LRDs, or Light Receiving Diodes, are not widely used today.)

data — Computer input. (A little-known fact is that only one source of data exists in the United States. A small general store in Waukegan, Illinois, sells data that are analysed and processed by all computers.)

data analysis — Psychological treatment of mentally ill data.

binary — A system of numbering with only the digits 0 and 1, used mainly by people who have difficulty with large numbers like 3.

BASIC — A high-level language that converts mathematical equations into syntax errors.

Tiny BASIC — A version of BASIC used by short people.

duplex — Simultaneous bi-directional data transmission; also known as split level.

register — The first thing one must do to get a computer license.

Illustrations by Bryant Wood

diskette — A Frisbee modified by a steamroller.

hexadecimal — To cast a spell on a number, as when programmers say that Friday the Dth is unlucky.

printed circuit — An electronic design found in magazines and books.

FORTRAN — A higher-level computer language used by scientific programmers who require a language capable of more sophisticated screw-ups than possible with BASIC.

computer club — An instrument used for delicate adjustment of sensitive electronics; also called a sledgehammer.

Silicon Valley — The area around Santa Clara, California, where there is a heavy concentration of semiconductor manufacturers. A similar area in the East is near Buffalo, New York. Integrated circuits from the latter region are thus known as Buffalo chips.

analog — The inverse of a logarithm.

digital — done by fingers; e.g., grasping a computer club to correct a computer malfunction.

peripheral — A computer accessory, e.g., a programmer. (A programmer who spots program errors easily has peripheral vision. One who cannot has 8080 vision.)

normalize — To take a programmer away from his computer.

program — A broadcast that occasionally interrupts commercials.

error — A phenomenon produced by computers, never by programmers.

hardware — Hammers and nails used to build computers.

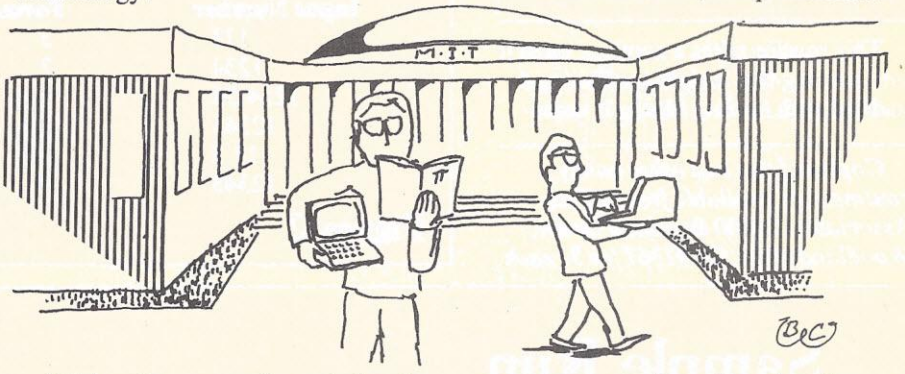
firmware — A computer company, as in "That's the firmware I bought my computer."

Star Trek — A computer game that simulates the sidewalk of Grauman's Chinese Theater in Hollywood.

integrated circuit — A circuit that has a mixture of black and white components. A circuit may be integrated by placing some of the components on a bus such as the S-100.

Altair — A place where one sacrifices computers.

MITS — A group of students from the Massachusetts Institute of Technology.



Intel — A company formed after the breakup of the giant Show-Intel Corp.

GOTO — A BASIC programming instruction for Monopoly, frequently associated with jail, where the most creative commercial computer programmers find themselves.

card guide — Hoyle's rules.

JUMP — Instruction given to a computer on the ledge of a tall building.

serial access — Opening in a box of breakfast food.

I/O — Financial statement of a computer owner.

manual — A book of instructions provided by computer, software and peripheral manufacturers. It contains all necessary instructions except the most important ones.

bootstrap — Item of apparel worn by cowboy computer programmers in the Old West, as in saying, "He died with his bootstraps on."

PROM — A party where junior programmers t e their dates.

+ — BASIC symbol for addition, except when in red, when it means first aid.

****** — FORTRAN symbol for mediocre movie.

glitch — An oscilloscope trace seen during normal computer operation, not to be confused with the trace seen when the computer is actually working correctly.

IC — Indication of comprehension.

processor — A machine that digests data, words or food.

programmer — A person known for wit, intelligence, logical thought and profound wisdom. Adept at socializing with machines. Sometimes writes computer dictionaries.

Formatting Numbers in 8K BASIC

BY BILL ROCH

How often have you thought "Wouldn't it be nice if my 8K BASIC had a PRINT USING ability. Then my computer output would look more professional, instead of that 'dumb' BASIC field output where the numbers are all left justified".

There is a way to beat the 8K BASIC at its own game. Let your computer turn the numbers into formatted strings, then print the strings.

Normal 8K Output	This Routine's Output
2	2
22	22
222.22	222.22

Figure 1

This routine takes a number, turns it into a string that is right justified and padded with leading blanks if necessary. See Figure 1. Not only that, but numbers can carry a minus sign and a decimal point when required.

The routine requires two input values: F9 and N9. N9 is the number to be formatted and F9 describes the way to format the number. The formatted string output variable is T$. See Figure 2. (Lower case "b" stands for "blank".)

The 8.2 and 8.3 in Figure 2's format column mean the field is eight characters long with two and three decimal places, respectively. When a number has more characters than will fit in the string or in the integer portion of the string, the string is filled with asterisks and an error flag is set.

The routine begins by determining how long the field will be and how many decimal places are required. It also checks if the input number is negative. The location of the incoming number's decimal is determined. The integer part of the number is obtained and a decimal point is concatenated on if necessary. Next, the fraction part of the number is concatenated on if required. If the fraction part of the number is too long, the fraction part is truncated to size. If the fraction part is too short, the decimal number is brought up to size by adding zeros. Numbers too long to fit in the required format are disregarded and the returned string T$ contains asterisks. The error flag is also set. □

Copies of this and other handy routines are available from Elliam Associates, 24000 Bessemer Street, Woodland Hills, CA 91367 for $1 each.

Input Number	Format	Output String
123	3	123
1234	7	bbb1234
1234.56	8.2	b1234.56
12345	0.5	.12345
−12.3	8.3	b−12.300
12345	3	***

Figure 2

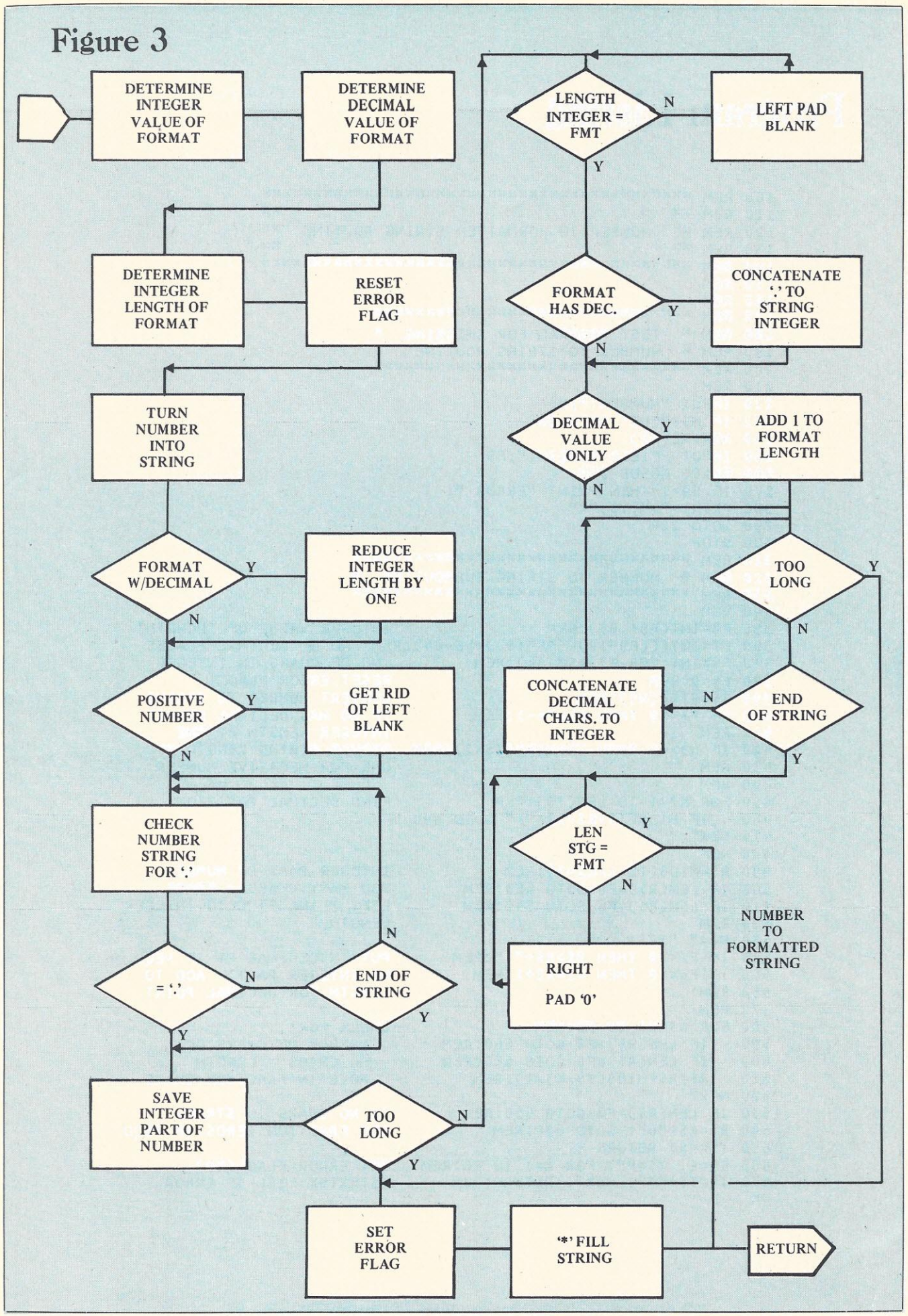
Sample Run

```
NUMBER:? 12345
FIELD LENGTH:? 6
> 12345<

NUMBER:? 12345
FIELD LENGTH:? 4
ERROR >****<

NUMBER:?
          123.45
FIELD LENGTH:? 7.2
> 123.45<

NUMBER:? -1234.56
FIELD LENGTH:? 10.3
> -1234.560<

NUMBER:? 1234.5678
FIELD LENGTH:? 8.2
> 1234.57<

NUMBER:? END
BREAK IN 300
OK
```

Program Listing

```
100 REM ******************************************
110 REM **                                      **
120 REM **  NUMBER TO FORMATTED STRING ROUTINE  **
130 REM **                                      **
140 REM ******************************************
150 REM
160 REM
170 REM ********************************
180 REM *  TEST PROGRAM FOR CHECKING   *
190 REM *  NUMBER TO STRING ROUTINE    *
200 REM ********************************
210 REM
220 INPUT "NUMBER:";N$
230 IF N$="END" GOTO 300
240 N9=VAL(N$)
250 INPUT "FIELD LENGTH:";F9
260 E9=0: GOSUB 350
270 IF E9=1 THEN PRINT "ERROR ";
280 PRINT ">";T$;"<"
290 GOTO 220
300 STOP
310 REM ********************************
320 REM *  NUMBER TO STRING SUBROUTINE  *
330 REM ********************************
340 REM
350 F8=INT(F9+.05):REM                  INTEGER VALUE OF 'LENGTH'
360 F7=INT(((F9*10)-(F8*10))+5E-04):REM  NO OF DECIMAL PLACES
370 F6=INT((F8-F7)+5E-04):REM            NO OF CHARS IN INTEGER
380 E9=0:REM                            RESET ERROR FLAG
390 T$=STR$(N9):REM                     CONVERT NUMBER TO STRING
400 IF F7<>0 THEN F6=F6-1:REM           IF NO HAS DECIMAL REDUCE
410 REM                                 INTEGER LENGTH BY ONE
420 IF N9>-1 THEN T$=MID$(T$,2):REM     REDUCE STRING LENGTH BY
430 REM                                 ONE FOR NEGATIVE NUMBER
440 REM
450 FOR K2=1 TO LEN(T$):REM             FIND DECIMAL POSITION
460   IF MID$(T$,K2,1)="." GOTO 490
470 NEXT
480 REM
490 R$=MID$(T$,1,K2-1):REM              INTEGER PART OF NUMBER
500 IF LEN(R$)>F6 GOTO 660:REM          TOO MANY CHARS - ERROR
510 IF LEN(R$)=F6 GOTO 540:REM          LEFT BLANK FILL TO INTEGER
520 REM                                 LENGTH
530 R$=" "+R$: GOTO 510
540 IF F7<>0 THEN R$=R$+".":REM         PUT IN DECIMAL PT IF REQD
550 IF F6<>0 THEN K2=K2+1:REM           NO INTEGER PART - ADD TO
560 REM                                 LENGTH FOR DECIMAL POINT
570 REM
580 FOR K3=K2 TO F8:REM                 CHECK FOR:
590   IF LEN(R$)>F8 GOTO 660:REM        . NUMBER OF CHARS OK
600   IF LEN(R$)=F8 GOTO 650:REM        . NO CHARS = LENGTH
610   R$=R$+MID$(T$,K3,1):REM           . MOVE IN FRACTION CHARS
620 NEXT
630 IF LEN(R$)=F8 GOTO 650:REM          CK NO CHARS IN STRING
640 R$=R$+"0": GOTO 630:REM             ADD FRACTION ZEROS IF REQD
650 T$=R$: RETURN
660 E9=1: T$="": FOR K=1 TO F8:REM      SET ERROR FLAG (E9)
670 T$=T$+"*": NEXT: RETURN:REM         ASTERISK FILL IF ERROR
OK
```

Figure 3


DETERMINE INTEGER VALUE OF FORMAT
DETERMINE DECIMAL VALUE OF FORMAT
DETERMINE INTEGER LENGTH OF FORMAT
RESET ERROR FLAG
TURN NUMBER INTO STRING
FORMAT W/DECIMAL
Y
N
REDUCE INTEGER LENGTH BY ONE
POSITIVE NUMBER
Y
N
GET RID OF LEFT BLANK
CHECK NUMBER STRING FOR '.'
= '.'
N
Y
END OF STRING
N
Y
SAVE INTEGER PART OF NUMBER
TOO LONG
N
Y
SET ERROR FLAG
'*' FILL STRING
RETURN
LENGTH INTEGER = FMT
N
Y
LEFT PAD BLANK
FORMAT HAS DEC.
Y
N
CONCATENATE '.' TO STRING INTEGER
DECIMAL VALUE ONLY
Y
N
ADD 1 TO FORMAT LENGTH
TOO LONG
Y
N
END OF STRING
N
Y
CONCATENATE DECIMAL CHARS. TO INTEGER
LEN STG = FMT
Y
N
RIGHT PAD '0'
NUMBER TO FORMATTED STRING

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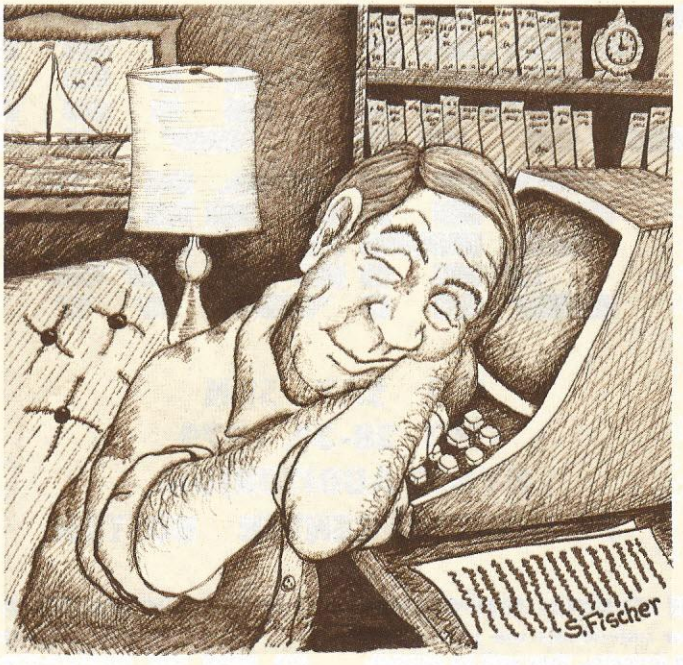
CIRCLE 45

The Hardness Factor

BY MARTIN J. PETERSEN, JR.

Have you ever wondered why some computer games keep you entertained for long periods of time, and others bore you after only a few mintues? It isn't the basic game itself (or its hundreds of variations) that's at fault, but your relationship to the computer. If the game is too easy and you always win, you get bored quickly. On the other hand, if the game is too hard and the computer wins all the time, you become frustrated and quit. The longest "enjoyment period" seems to be when the win/lose ratio is even. The excitement is like being at a ball game when the score is tied.

Since no two people are alike, the problem with most computer programs is that they're written for the "average" person and not for you. Consider a typical artillery game, where a target appears at x meters distance, and you have to elevate your gun to hit the target. (From a basic knowledge of physics you've probably figured out that your range will increase as you elevate your gun from 0 to 45 degrees; then the range will decrease as you elevate your gun beyond 45 degrees.) Obviously, if you had to get the exact distance with your shot, you'd probably never hit the target. So the computer (game programmer) allows a miss distance of about 100 meters. Shots landing within this 100 meters are considered hits. But 100 meters may be too easy for you if you are skilled in math; or it may still be too hard for you if you're not.



One way to improve the program and customize it to your particular skill level is to add a player-selected "hardness factor." In the case of the above artillery game, look at the program listing and find the line that instructs the computer to destroy the target whenever the miss-distance is equal to or less than 100 (or whatever number is used). Substitute "H" for that number, and let the player enter the value of H — anything from 0 (exact hit) to maybe a few thousand meters.

A better way, however, is to let the computer program the hardness factor itself, according to the progress of the game. For instance, the game would always start with the easiest hardness factor. After each play, the hardness factor increases by one, and continues to increase as long as the player is winning. When the computer starts winning, the hardness factor decreases by one after each round. Thus, the game automatically adjusts itself to the skill level of the player, increasing the player's enjoyment. At the end of the game, the computer produces a print out, letting the players know their skill-level.

Hardness factors improve other programs too, particularly math programs designed for children. Based on the percentage of correct responses or even (if your computer languages allow it) on the time it takes for a child to enter a response, the hardness factor controls the relative difficulty of the questions generated by the computer.

But, even with a hardness factor, shooting at sitting targets can get boring. Next let's see how to program your targets to move.

In games like "Depth Charge" or "Submarine," the player tries to sink a submarine located somewhere in a three-dimensional grid (coordinates: x, y, z). The maximum size, or search area, is set by the player (A, B, C). At the beginning of the game, the computer establishes the submarine's position via a random number generator. But from then on, the submarine just sits there waiting to be depth-charged. Wouldn't it be more exciting if the sub moved, just like a real one?

Of course, one way to move the sub is to program the random number generator to reposition the sub after each shot, but this wouldn't be realistic. Spock, of *Star Trek* fame, may be able to disassemble himself via trnsporter and reappear instantaneously at a remote location, but real objects move at predicatable speeds and directions. They cannot be in one place one instant and at another place far removed the next. Besides, hitting the target that moves at random is no more fun than making a lucky guess. But hitting a moving target by predicting its course gives you a feeling of accomplishment.

In this example, the random number generator sets the sub's starting position (x, y, z — known only to the computer) and then sets the sub's course, one of 27 possible directions (again, known only to the computer). All the player knows about the sub's movement is that, in each of the three directions (x, y, or z) considered independently, the sub will either (1) retreat one square per shot, (2) not move or (3) advance one square per shot. When the sub reaches the limit of the search area in any direction, it will turn around and head the other way.

Here's a step-by-step procedure to incorporate the moving sub into your own program:

1. Program your computer to select sub's starting position (x, y, z) via random number generator. Be sure x, y or z is not larger than A, B or C, the search area limits. Example: X=INT(RND(0)*A) yields a random number between 0 and A (including 0 but not A). To include "A", use "A+1" in the

Illustration by Stephen C. Fischer

formula. My computer, a SWTPC, uses RND(0) as a "seed"; but other computers use different seeds, so check your own BASIC manual.

2. Next, the computer selects the submarine course from the starting point, once in each game right after x, y and z are chosen, as follows:

```
(line #)    GOSUB 600 (or line # you choose)
            X1=K4
            GOSUB 600
            Y1=K4
            GOSUB 600
            Z1=K4
600         K4=INT((3+INT(RND(0)*10))/3)
            IF K4>3 THEN 600
            RETURN
```

K4 is either 1, 2 or 3, generated at random. "1" means the sub will retreat one square, "2" means the sub will not move, and "3" means the sub will advance one square. Since each axis is independent, the sub could be advancing one square per shot in the x direction, retreating one square per shot in the y direction, and not be moving at all in the z direction. With 3 possibilities in each of three directions, the total number of possible directions is 3 cubed, or 27.

3. After each shot, the submarine moves one position according to the following instructions:

```
(line #)    ON X1 GOSUB 700, 750, 800
            ON Y1 GOSUB 850, 900, 950
            ON Z1 GOSUB 1000, 1050, 1100

700         IF X=0 THEN X1=3        (turns sub around when
            IF X=0 THEN 800           "0" is reached.)
            X=X-1                   (retreats sub one square)
            RETURN

750         X=X                     (this instruction actually
            RETURN                    not necessary, but is
                                      helpful in debugging.)

800         IF X=A THEN X1=1        (turns sub around when
            IF X=A THEN 700           "A" is reached.)
            X=X+1                   (advances sub one square)
            RETURN
```

The sub's movement in the y and z directions is identical to movement in the x direction, above. Substitute y or z for x and B or C for A, and use the appropriate GOSUB line numbers.

You can apply this program to single axis motion using just the x routine; or to 2-dimensional motion using x and y.

You can add sophistication by moving the target at speeds other than one square per shot. For example, substitute "X=X+M1" or "X=X-M1" for X=X+1 or X=X-1 in the 700 and 800 subroutines, where M1 is a random number or a programmed number of your choice. Do the same for the y and z routines using M2 and M3.

As another refinement, you can program all Ms to be zero if the depth charge explodes within one square of the sub — equivalent to the "All stop" command given in those old war movies when the destroyer gets too close. Or, make the computer initiate a new course and speed when the depth-charges get too close, giving the player at least one decent shot before the sub changes direction.

Happy hunting!

PUZZLER

Using Tree-Searching and Evaluation Techniques in Problem-Solving

BY DAVID W. STOCKBURGER

The computer is a tireless companion and competitor, always ready to play another game or make another attempt to solve a puzzle. This article demonstrates a program for your computer which solves the puzzle I call Truck. Although emphasis will be placed on puzzles here, the ideas presented are easily extended to more complicated competitive games.

Truck is played on a triangular board containing fifteen holes and fourteen pegs. The puzzle is played by sequentially jumping pegs and removing the peg that was jumped. The object of the puzzle is to remove as many of the pegs as possible, with the ultimate achievement realized when only one peg is left.

This puzzle is often seen in truck stops, probably as a diversion from poor service and food. I've been unable to locate the puzzle in any puzzle encyclopedias, so I call the puzzle Truck from its common location. The puzzle is often presented as a crude measure of intelligence with the fewer the pegs remaining, the more intelligent the player — supposedly.

If a computer (is) to solve a puzzle intelligently, it must understand the rules of play, have a procedure to carry out the rules and learn by experience. The puzzle is represented as a computer program. The form of the representation is dictated by the particular language the programmer is using. There exist, however, certain abstract similarities between the various types of representations. One approach to representation includes the concepts of states and operations. A *state* is a particular board configuration. An *operation* is a transformation from one state to another. It corresponds to a move in the puzzle.

In most illustrations of states and operations, states are represented by figures or numbers while operations are represented by arrows. For example, Figure 1 illustrates a transformation from one state to another in the puzzle Truck. The complete set of all possible states is called the *state space* of the problem.

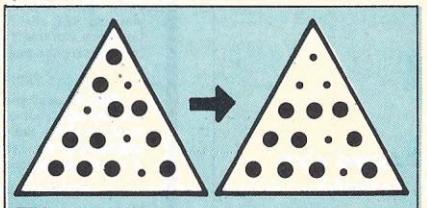


Figure 1

A *graph* of the problem illustrates possible applications of operations to states. A *tree* is a special graph where directional moves from a given state to another state are sequentially given. An example tree for the puzzle Truck is presented in Figure 2. By starting at the topmost state, or *root node,* and following a particular *path* or *branch* down the tree, a single solution to the puzzle is specified. The end states, or *terminal nodes,* represent possible solutions to the puzzle from a given initial state.

After the problem has been given a representation, the next step is to search through the state space for an optimal solution. This involves internally generating a tree of the problem and searching the branches of the tree for a solution. One algorithm for searching trees is the depth-first strategy. Depth-first search has the advantage of making minimal demands on the storage capacity of the computer; the disadvantage is possibly requiring a great deal of time. Some of the solutions on the demonstration program have taken over two hours.

The depth-first search subroutine in Puzzler proceeds by generating the leftmost path down the tree until a terminal node is reached and no more states may be generated from that position. The computer stores the value of that terminal state (the number of pegs remaining) and the path to that state. The computer then backs up the tree until it reaches a state where all the possibilities have not been examined. The next path is followed until termination and the number of pegs remaining are computed. This value is compared with the previous value. If it is lower, the computer replaces the previous value and path with the current one. This procedure is repetitively followed until either a solution is reached (one peg remaining) or all possible paths have been examined. This procedure guarantees an optimal solution. A flow-diagram of this algorithm is presented in Figure 3.

The order of generation of moves by this subroutine corresponds to the numbers written beside the arrows in Figure 2. Note that the procedure would stop after 9, because only one peg remains, but further numbers are given on the tree for illustration.

This program is presented as a demonstration of depth-first search techniques. It was written in BASIC on a Polymorphic 88 with 24K of RAM memory. It requires a BASIC which has the ability to handle multi-dimensional arrays and arrays within arrays.

To search a tree in a reasonable amount of time, you need a relatively efficient method of generating moves. After a number of aborted attempts, I adopted the following representation for Puzzler. It has the dual advantage of searching only positions where a possible move might be found and allowing a marker to identify which moves have been attempted and which have not.

The possible states of the puzzle are represented in a vector Z(I), I = 1 to

15, where Z=0 (peg absent) or 1 (peg present). There are 36 possible legal jumps, each pair occuring in one of 18 possible strings of three positions in a row. Operations are represented in a matrix R(I,J), where I is the three positions in a row and J is the 18 possible strings. A legal move occurs when the middle position of the string is occupied as is one of the two outside positions. A summary and example of the representation is given in Figure 4. Moves are generated by sequentially comparing the board positions with the possible jumps. The marking of the last jump attempted or completed is the position in the loop (1 to 18) at the time it was attempted.

The display is generated in a subroutine starting in line number 1250. It utilizes the POKE command in BASIC because the PLOT command was too slow. You'll have to change this routine if you use a different machine with different sections of memory mapped into the display, or different modes of mapping memory into the display.

The program first asks the user at what point the depth-first search should begin. The number given is the number of pegs remaining at the start of the search; thus the larger the number, the greater the search time. It takes over two hours to search for a solution with 10 pegs remaining.

Following the user's response, the program asks which peg the user would like to delete at the beginning. The computer begins play by examining all possible moves from the initial position, assigning a random number to each legal move, and selecting the move which has the largest number.

The random number is assigned in a subroutine beginning in line number 1960, which could be used in more advanced programs to return an evaluation of the move. Instead of randomly selecting moves, the computer would select moves that have the greatest chance of success (the largest evaluation function). The random assignment of an evaluation function is used here to generate a statistical baseline, making it possible to determine if the program is really learning.

The procedure of randomly selecting from all possible moves continues until the number of pegs remaining equals the point where the depth-first search is to begin. At this point control is shifted to the subroutine starting in line 1360 and the depth-first search procedure outlined earlier is carried out. This subroutine returns to the main program if a solution is found or if all possible paths have been examined.

The program is set up to randomly generate both a new starting position and a new point to begin the depth-first search (from 3 to 10 pegs remaining). Play continues until the user requests control.

While it may be possible for a computer to be intelligent without a search procedure, the addition of search adds a great deal to the power to solve problems and play games. The depth-first tree searching procedure discussed here and used by Puzzler is one of a number of search algorithms useful for problem-solving and game playing. Depth-first search is most useful when the search is not too large, the maximum depth of the search is known and memory is limited.

I would like to thank Rufus McClure at the Computer Bit who allowed me to develop programs under the guise of selling computers and came to my aid when nothing seemed to work. □

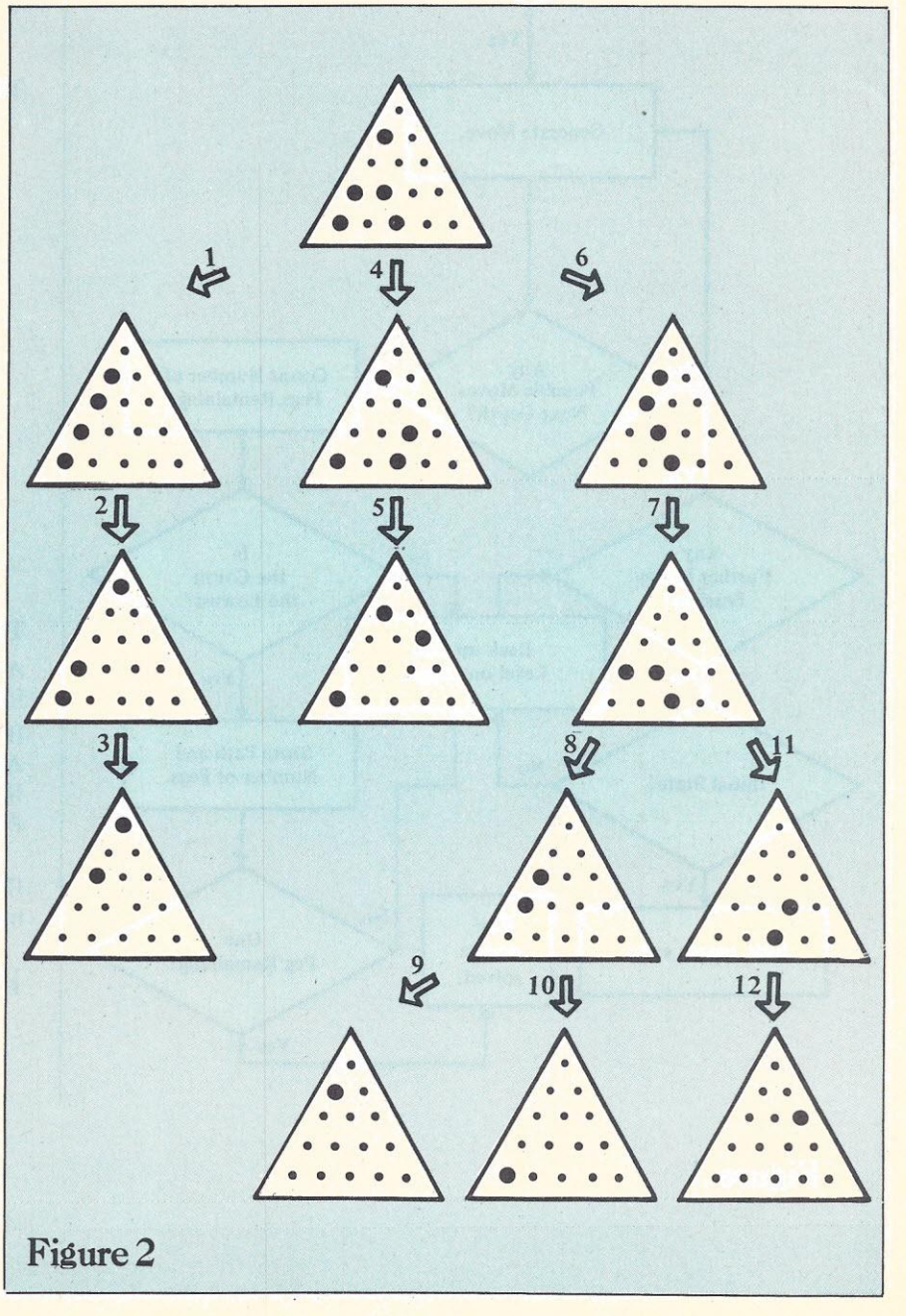


Figure 2

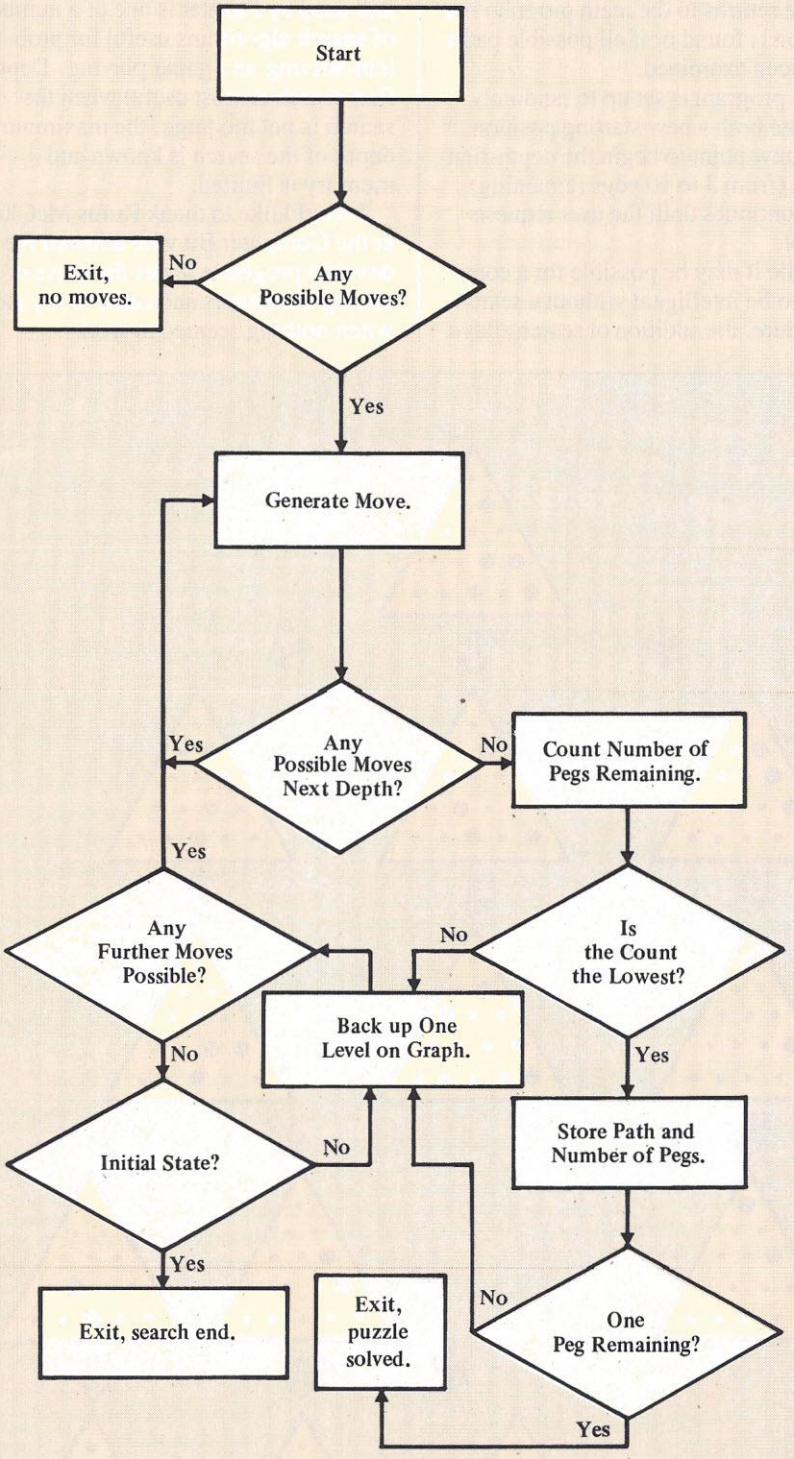
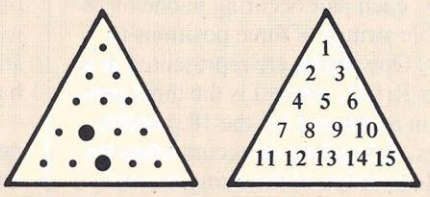


Figure 3



The Board Representation

For I=1 to 15:
Z(I)=1 if peg present
=if peg not present

The Move Representation

For J=1 to 18 — Includes 18 possible arrangements of three numbers in a row in the above representation.

For K=1 to 3 — The three numbers.

R(K,J)=The actual position numbers.

For Example:
R(1,8)=4
R(2,8)=8 Defined in DATA
R(3,8)=13 statement.

The Move Generator

A legal move results if either of the following IF statements are satisfied.

IF (Z(R(J,1))=1) AND (Z(R(J,2))=1) AND (Z(R(J,3))=0)
IF (Z(R(J,1))=0) AND (Z(R(J,2))=1) AND (Z(R(J,3))=1)

Where J=8, the second of these two IF statements is satisfied and a legal move results.

Figure 4

Program Listing

```
10 REM **** PUZZLER **** A DEMONSTRATION OF PROBLEM-SOLVING
20 REM COPYWRITE 1978 BY DAVID W. STOCKBURGER
30 REM PSYCHOLOGY DEPARTMENT, SOUTHWEST MISSOURI STATE UNIVERSITY
40 REM SPRINGFIELD, MISSOURI 65802
50 REM DATA AND DIMENSION STATEMENTS
60 T7=TIME(0)\T7=0
70 INPUT "START DEPTH-FIRST SEARCH AT MOVE   ",Y
80 N5=0
90 REM LEGAL MOVE DEFINITION PARAMETERS
100 REM R(I,J) - I=THREE PINS, J=EIGHTEEN POSSIBILITIES
110 REM Z(1) IS THE CURRENT BOARD POSITION 0=NO PIN 1=PIN
120 REM X(I) IS THE BOARD POSITION BEING SEARCHED
130 REM M(D) IS CURRENT PIN REMOVED AT DEPTH D
140 REM M1(D) IS BEST MOVE THUS FAR WITH M(D)
150 REM K(D) MOVE AT DEPTH D
160 REM T1 IS BEST TOTAL PINS LEFT
170 REM P(I) IS NEEDED FOR DISPLAY
180 DIM R(3,18),Z(15),M(18),N(18),K(18),C(18)
190 DIM P(15),E(4,10)
200 DIM X(15)
210 DIM N6(3,100)
220 REM READ IN LEGAL MOVES
230 FOR I=1 TO 18
240 FOR J=1 TO 3
250 READ R(J,I)
260 NEXT\NEXT
270 DATA 1,2,4,2,4,7,4,7,11,3,5,8,5,8,12,6,9,13
280 DATA 1,3,6,3,6,10,6,10,15,2,5,9,5,9,14,4,8,13
290 DATA 11,12,13,12,13,14,13,14,15,7,8,9,8,9,10,4,5,6
300 REM READ IN INFORMATION NEEDED FOR DISPLAY
310 FOR I=1 TO 15
320 READ P(I)
330 NEXT
340 P1=54
350 DATA 63582,63706,63714,63830,63838,63846
360 DATA 63954,63962,63970,63978,64078,64086
370 DATA 64094,64102,64110
380 PRINT "THIS IS A PROGRAM TO PLAY TRUCK"
390 PRINT "                  1"
400 PRINT "               2     3"
410 PRINT "            4     5     6"
420 PRINT "         7     8     9    10"
430 PRINT "     11    12    13    14    15"
440 PRINT " "
450 PRINT " "
460 INPUT "SELECT INITIAL MISSING PIN   ",Q
470 FOR I=1 TO 15
480 Z(I)=1
490 NEXT
500 REM SET INITIAL MISSING PIN
510 Z(Q)=0
520 REM SET INITIAL DISPLAY ON SCREEN
530 GOSUB 1250
540 REM EXECUTIVE PROGRAM
550 REM GENERATE AND EVALUATE MOVES
560 L=0
570 REM SEARCH FOR ALL LEGAL MOVES
580 FOR I=1 TO 18
590 IF Z(R(2,I))=0 THEN 680
600 IF Z(R(1,I))+Z(R(3,I))<>1 THEN 680
610 L=L+1
620 REM STORE EACH OF THE L MOVES TEMPORARILY IN E(I,L)
630 E(2,L)=R(2,I)
640 E(1,L)=R(1,I)
650 E(3,L)=R(3,I)
660 REM EVALUATE THE MOVE, STORE IN E(4,L)
670 GOSUB 1960
680 NEXT
690 F=0\L1=0
700 IF L=0 THEN 1010
710 REM FIND OUT WHICH MOVE HAS THE LARGEST EVALUATION
720 FOR I=1 TO L
730 IF E(4,I)>F THEN L1=I
740 IF E(4,I)>F THEN F=E(4,I)
750 NEXT
760 REM MAKE THE BEST MOVE
770 Z(E(2,L1))=0
780 A=Z(E(1,L1))
790 Z(E(1,L1))=Z(E(3,L1))
800 Z(E(3,L1))=A
810 REM DISPLAY MOVE
820 GOSUB 1250
830 T=0
840 REM COUNT NUMBER OF PINS REMAINING
850 FOR I=1 TO 15
860 IF Z(I)=1 THEN T=T+1
870 NEXT
880 REM START DEPTH-FIRST SEARCH IF COUNT LOW ENOUGH
890 IF T>Y THEN 560
900 REM DO DEPTH-FIRST SEARCH
910 GOSUB 1360
920 REM DISPLAY RESULTS ONE MOVE AT A TIME
930 FOR I2=1 TO T-T5
940 A = Z(R(1,N(I2)))
950 Z(R(2,N(I2)))=0
960 Z(R(1,N(I2)))=Z(R(3,N(I2)))
970 Z(R(3,N(I2)))=A
980 GOSUB 1250
990 NEXT
1000 GOTO 1050
1010 T5=0
1020 FOR I=1 TO 15
1030 IF Z(I)=1 THEN T5=T5+1
1040 NEXT
1050 T7=T7+TIME(0)
1060 T7=T7/3600
1070 REM COUNT PINS REMAINING AND DISPLAY TIME AND NUMBER
1080 PRINT "TOTAL PINS REMAINING  ",T5
1090 PRINT "TIME  ",T7
1100 REM RESET CLOCK AND RANDOMLY SELECT STARTING PIN AND DEPTH
1110 T7=TIME(0)\T7=0
1120 Q=INT(RND(0)*16)
1130 IF Q<1 THEN 1120
1140 IF Q>15 THEN 1120
1150 Y=INT(RND(0)*11)
1160 IF Y<1 THEN 1150
1170 IF Y>10 THEN 1150
1180 REM DISPLAY AND TIME DELAY
1190 PRINT "NEW STARTING PIN =  ",Q
1200 PRINT "DEPTH-FIRST SEARCH BEGINS WITH ",Y," PINS REMAINING"
1210 FOR I=1 TO 100
1220 FOR J=1 TO 100
1230 NEXT\NEXT
1240 GOTO 470
1250 REM DISPLAY SUBROUTINE
1260 REM CLEAR SCREEN AND SET CURSOR
1270 PRINTCHR$(12),\PLOT 0,47,0
1280 FOR I=1 TO 15
1290 IF Z(I)=1 THEN P2=0 ELSE P2=63
1300 IF Z(I)=1 THEN P3=0 ELSE P3=45
1310 POKE(P(I)-57344),P2
1320 POKE(P(I)-57344)+1,P3
1330 POKE(P(I)-57344)+2,P2
1340 NEXT
1350 RETURN
1360 REM DEPTH-FIRST SEARCH
1370 PRINT "BEGIN DEPTH-FIRST SEARCH"
1380 REM SET COUNTERS AND MARKERS TO INITIAL VALUES
1390 FOR I=1 TO 15-Y
1400 K(I)=0
1410 N(I)=0
1420 NEXT
1430 D=1\T5=T
1440 REM SET TEMPORARY MATRIX FOR SEARCH
1450 FOR I=1 TO 15
1460 X(I)=Z(I)
1470 NEXT
1480 REM RESTART LOOP AT POINT LEFT OFF - K(D)
1490 FOR I=K(D)+1 TO 18
1500 REM SEARCH FOR LEGAL MOVE
1510 IF X(R(2,I))=0 THEN 1750
1520 G1=X(R(1,I))+X(R(3,I))
1530 IF G1<>1 THEN 1750
1540 REM LEGAL MOVE FOUND
1550 K(D)=I
1560 REM SET DEPTH POINTER - D - TO NEXT DEPTH
1570 D=D+1
1580 REM MAKE MOVE
1590 X(R(2,I))=0
1600 A=X(R(3,I))
1610 X(R(3,I))=X(R(1,I))
1620 X(R(1,I))=A
1630 REM COUNT NUMBER OF PINS REMAINING
1640 T4=0
1650 FOR I1=1 TO 15
1660 T4=T4+X(I1)
1670 NEXT
1680 REM IF BEST SEQUENCE THUS FAR STORE IN N(I1)
1690 IF T4>=T5 THEN 1740
1700 T5=T4
1710 FOR I1=1 TO D
1720 N(I1)=K(I1)
1730 NEXT
1740 EXIT 1480
1750 NEXT
1760 REM EXIT IF SOLUTION FOUND
1770 IF T5=1 THEN RETURN
1780 K(D)=0
1790 REM BACK UP ON TREE
1800 D=D-1
1810 REM EXIT - SEARCH COMPLETED IF D=0
1820 IF D=0 THEN RETURN
1830 REM IF NOT RESET TEMPORARY X(I) MATRIX TO LAST
1840 REM POSITION ON TREE
1850 FOR I=1 TO 15
1860 X(I)=Z(I)
1870 NEXT
1880 T7=T7+TIME(0)
1890 FOR I=1 TO D-1
1900 A=X(R(1,K(I)))
1910 X(R(2,K(I)))=0
1920 X(R(1,K(I)))=X(R(3,K(I)))
1930 X(R(3,K(I)))=A
1940 NEXT
1950 GOTO 1490
1960 REM EVALUATION SUBROUTINE
1970 REM IN THIS VERSION RETURNS RANDOM NUMBER
1980 E(4,L)=RND(0)
1990 RETURN
2000 REM RECORD FILE SUBROUTINE
2010 FOR I=1 TO 15
2020 PRINT "PIN  ",N6(1,I),"  DEPTH ",N6(2,I),"  LEFT ",N6(3,I)
2030 NEXT
2040 N5=0
2050 RETURN
```

NCC '79 Report

Apple and Radio Shack both revealed new versions of their popular computers at the Natonal Computer Conference In addition, Apple announced a Pascal language for their system. NCC's biggest disappointment came from Texas Instruments, who did *not* unveil their new computer at the show.

Personal computerists have long awaited Texas Instruments' entry into the home computer marketplace, and many hoped TI would announce their new computer at NCC in New York. Sure enough, TI introduced their computer during NCC week — but halfway across the country, at Chicago's Consumer Electronics Show.

TI's choice of the CES over the NCC reflects their marketing view. They see their computer as a true home appliance, intended for use primarily by non-computer and non-programmer types. (See Russ Walter's Product Close-Up in this issue for a review of the TI machine.)

News from Apple and TRS-80 also reflect these companies' marketing plans. Both revealed new products designed to help them keep pace with the growing demand for micros in the non-computerist, non-hobbyist world.

The Apple II Plus is an enhanced, upgraded version of the Apple II. Several new features make the computer easier to use — a definite plus for business and education applications.

For example, Applesoft Extended BASIC is available in ROM on the Apple II Plus. Earlier Apple IIs featured Integer BASIC, a fast language suitable for graphics and games but too limited for more serious applications. If you wanted to run Applesoft, you had to load a tape or buy a $200 plug-in firmware card.

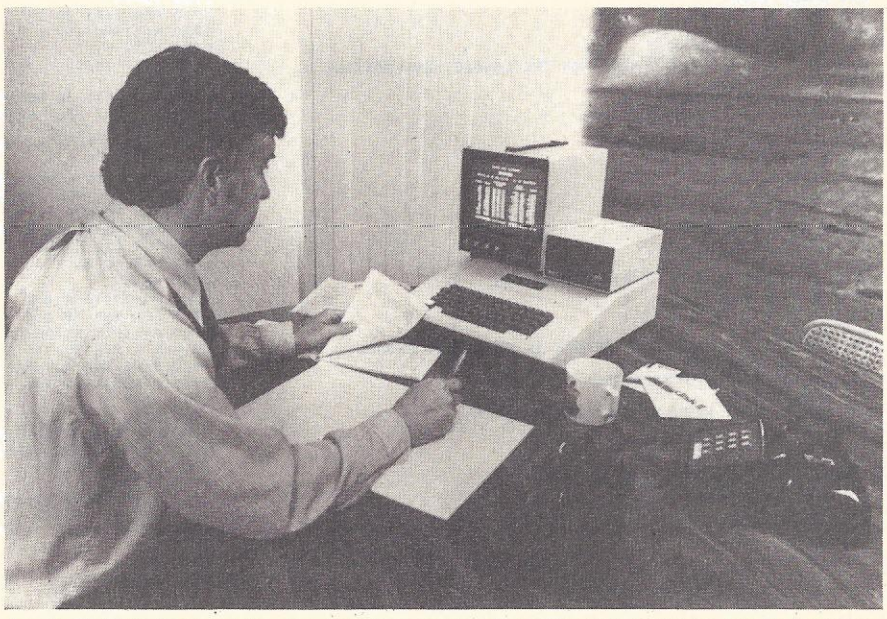
Applesoft Floating-Point BASIC, written by Microsoft, is comparable to other Microsoft BASICs. It features 9-digit arithmetic, high-resolution graphics routines and user-programmable error messages. Three data types are available — real, integer and string — as well as N-dimensional arrays and N-letter variable names (with only the first two letters signigicant). Scientific functions include exponents, logs, square roots, absolute values and random numbers as well as trig functions (sin, cos, tan, arctan) and logical operators (and, or, not). String operations feature comparisons of variables, concatenation (combining two strings into one), variable type conversion (ASC, STR and VAL functions) and substring separations (LEFT, RIGHT, MID and LEN functions).

A related feature of the Apple II Plus is the new Auto-Start control ROM, which automatically puts the machine into BASIC programming mode when the system is turned on. This feature eliminates preliminary commands, making the system easier for novices to use, Apple noted. On disk-based systems, the ROM will automatically load and run a user-specified program from disk — useful for business applications such as general ledger or inventory.

The Auto-Start ROM also modifies the function of the Reset key. On earlier Apples, the Reset key — located just above the Return key — wiped out programs and data stored in memory. Thus, if you hit the key accidentally, you could easily destroy several hours work — more than a minor annoyance. In its new incarnation, the Reset key simply halts program execution without losing the program or data. You can then resume running the program by typing a single command.

Price for an Apple II Plus system is the same as for an Apple II system of the same memory size. A 16K unit costs $1195. A 32K system sells for $1345, while a 48K goes for $1495.

For $495, you can get Apples's Lan-



Apple II Plus incorporates new features making the computer easier to use in business applications. Pascal programming language is also available for the system.

guage System. This package includes a Language Card, five diskettes containing Pascal, Applesoft BASIC and Integer BASIC, and manuals. The Language Card, which contains 16K RAM, replaces the Apple's built-in ROM. When you turn on the system, the Auto-Start ROM automatically loads your language of choice and you're ready to go. The Language System requires a 48K Apple II with disk.

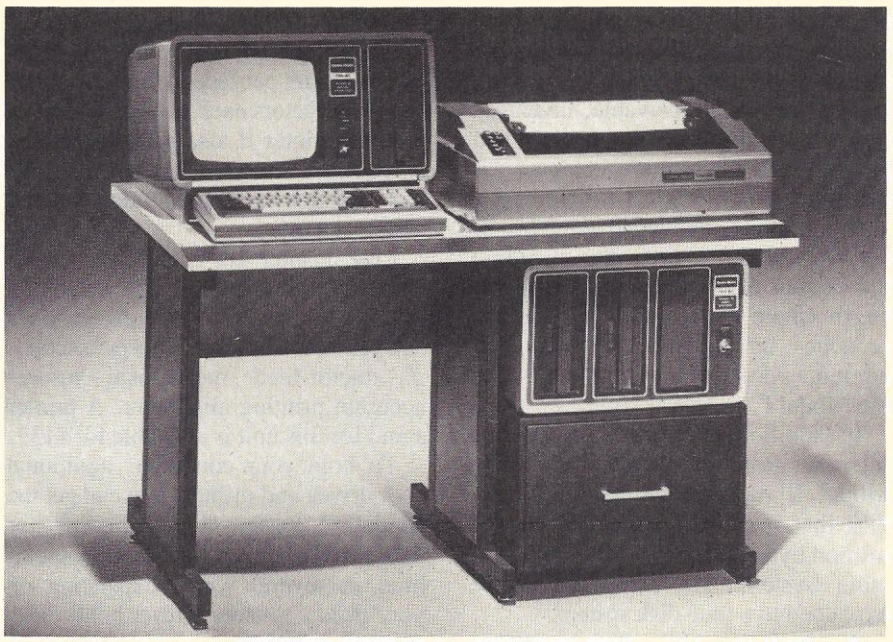
Many industry observers consider Pascal the wave of the future in micro computer languages. A structured programming language, Pascal was first implemented by Professor Niklaus Wirth in 1970. UCSD Pascal, offered by Apple, is the most widely used version of the language. (The University of California at San Diego is the center of academic interest in Pascal.)

Apple Pascal features the full Pascal language plus extensions for strings, disks, files and graphics. According to Apple, the language is simple and easy to learn, and offers several advantages over BASIC. As a structured language, Pascal simplifies writing large, complex programs. Also, the language's modularity makes maintenance easier; one programmer can more easily follow another's logic, and hence more easily modify a program.

Also, according to the company, built-in error checking reduces debugging time; and Pascal programs take less memory space and execute more quickly than equivalent programs in BASIC.

New Apple business software was also demonstrated at NCC. The diskette-based programs include Controller, a general ledger, accounts receivable and accounts payable system; Apple Post, a mailing list program; and Cashier, a point-of-sale inventory and cash control system. All three programs utilize error correction routines and formatted standard report output, the company said, and each comes with full documentation training manuals. Each program requires 48K RAM, dual disk drives, Applesoft and Printer IIA.

Designed for non-technical managers and clerks, Controller supports either cash or accrual bookkeeping, and maintains the ledger as well as customer and vendor accounts for many small businesses, Apple said. The program also prints checks and provides information summaries to aid managerial decision-making. The programs's General Ledger module allows up to 250 types of accounts with up to $100 million per account. Up to 1000 journal entries can be made per month.



Radio Shack's TRS-80 Model II is more than an upgrade of their original computer. The new system offers faster operating speed, built-in disk drives and other expanded features.

The Accounts Receivable module maintains up to 250 customer accounts and processes up to 1000 invoice statements per month, with individual transactions up to $100,000 each. Accounts Payable maintains a file of 100 vendors and allows 300 monthly invoices of up to $1 million each. Payables are organized by due date to aid cash flow planning. Price is $625.

Apple Post, which handles mailing lists of more than 2500 names, permits easy entry and editing of names, addresses and phone numbers, the company said. The program prints either lists or labels in either name or Zip code order. A "phonetic search" feature allows you to locate names even if you're unsure of the spelling. The system costs $49.95.

Cashier uses a single entry of a customer's account to generate sales receipts, billing records, mailing lists and accounting summaries. The package also processes back orders, down payments and refunds, and manages an inventory of more than 800 stock numbers. Price is $250.

For scientific and industrial users, Apple demonstrated technical applications. One computer, for example, used a stepper motor to control two spinning disks; each disk passed through slots in the other without collision. Another Apple controlled a Hewlett-Packard 4-color plotter, tracing analog inputs from a wave-form generator and human voices.

The new Apple Graphics Tablet functions like other digitizers, transforming pictorial and mapping information into digital form for display and storage by the computer.

Apple is also expanding its repair service this fall to include three levels of repair centers. Level 1, the one the customer will most often deal with, will be the Apple dealer himself. Thus, Apple said, customers should get same-day local service.

According to Apple, 90% of customers' problems can be diagnosed by the computer itself, then easily and quickly corrected. So Apple will train its dealers to be repairmen as well. Each dealer will have diagnostic software to test the motherboard, tape input/output, paddles, disk drives and peripheral interface cards. When the problem is located, the dealer then replaces the faulty part.

More complex repairs will be handles by Apple's Level II regional distributor or by the Level III factory-based Service Center.

For more information on Apple products, contact Apple Computer, Inc., 10260 Bandley Drive, Cupertino, CA 95014; (408) 996-1010.

Radio Shack's suprise at NCC was the introduction of an all-new computer. The TRS-80 Model II is *not* an upgrade of the original TRS-80. Rather, the company said, the Model II was designed to take up where the original left off. Radio Shack president Lewis Kornfeld anticipates the biggest market for the Model II will be "small businesses, small parts of large businesses and professionals in every field including accounting, law, medicine, engineering, manufacturing and so on." The machine can be used as a general purpose data processing com-

puter, an intelligent terminal and a word processor. Radio Shack now offers disk-based software for general ledger, accounts receivable, inventory control, mailing list management and payroll, and plans more software for the future.

Model II is not intended to replace or obsolete Model I, according to Radio Shack, but to provide capabilities that begin where the original TRS-80 approaches its upper limits. The new computer is software compatible with the Model I.

In addition to either 32K or 64K internal Random Access memory, Model II has one built-in 8" floppy disk that stores an additional one-half million bytes, including the Disk Operating System. The computer can be expanded to a four-disk system.

A built-in 12" high-resolution video monitor displays 24 lines of 80 normal characters or 40 expanded characters. It features upper and lower case letters. The 76-key detachable keyboard, with 10-key numeric keypad, includes functions such as Control, Escape, Caps, Hold and Repeat, and features two software-programmable Special Function keys.

An enhanced Level III version of the TRS-80's Level II BASIC language and "TRSDOS" operating system are automatically loaded in memory when the machine is turned on. In addition, each time the computer is powered up, it tests itself for proper operation.

Built-in input/output capabilities include two RS-232C channels and one Centronics parallel port. Future expansion is provided for through four plug-in slots for optional PC boards. According to Radio Shack, expansion boards are under development now.

The computer, which sells for $3450 in a 32K minimum configuration, will be marketed the same way as the Model I — that is, through Radio Shack stores. Stores, Computer Centers and authorized dealers will now accept orders for Model IIs, but display units will not be available until the anticipated backlog of orders is relieved.

A one-disk Model II with 64K RAM costs $3899. Other configurations including printers and additional disks are also available.

Model II can be expanded to include up to four disk drives. A one-drive expansion system (giving you a total of two drives) costs $1150; a two-drive system costs $1750; and a three-drive system sells for $2350.

Two printers are available for Model II. The TRS-80 Line Printer II sells for $999. The unit measures 15 x 11 x 5 inches and weighs 20 pounds. It prints 50 characters per second on 8-inch lines of 80 characters each, using a 7 x 7 dot matrix. Printer II also prints expanded (wide) letters under software control, and operates in both friction-feed and pin-feed modes.

Line Printer III is a larger, more expensive unit selling for $1999. It features 13-inch, 132-character lines and prints at 120 characters per second. A tractor-feed mechanism insures accurate printing alignment. A printer stand for this unit is available for $139.

To hold your computer, additional disk drives and printer, you can get the Model II System Desk. Selling for $350, this modular desk can be assembled in several ways, depending on your needs. A large drawer holds disks or other materials.

Radio Shack's Model II is more than an upgraded TRS-80.

Five business software packages are now available for the Model II, with more to come, Radio Shack said. The General Ledger system handles up to 500 accounts, and the Payroll system handles up to 500 employees. The Accounts Receivable package offers a variable number of accounts versus number of transactions, ranging from 300 accounts and 8000 transactions to 2000 account and 15000 transactions per month.

Retail Inventory stores information on 3000 items. The system accepts up to 300 vendors and produces various reports including year's sales history. The Mailing List Management program is suitable for churches, schools and other groups as well as for businesses, the company said.

Prices for these software packages range from $150 to $400.

For more information on Radio Shack products contact Radio Shack, 1400 One Tandy Center, Fort Worth, TX 76102; (817) 390-3272.

Telecomputing Corporation of America announced a time-sharing information system for home computers. Called The Source, the system features a large data base and program library which you can access for $2.75 per hour during off-peak times. Peak usage time rate is $15 per hour. There's an initial hook-up charge of $100.

Using The Source, you can tap all the information reported each day by the UPI, and also gain access to UPI's data bank of information compiled since 1972. You can get daily horoscopes and biorhythm reports, or request New York Stock Exchange information. In addition, The Source can report what music, theater and sports attractions are playing in various cities and tell you how to reserve tickets. You can learn what plane reservations are available, as well as the weather around the country.

Games available through the system include Star Trek, chess, roulette, football, baseball, basketball, blackjack and Civil War. Business programs include accounts payable and receivable, general ledger, payroll, inventory control, data base management, order entry, sales commission reports, cash flow analysis and prospect, customer and sales lists.

You access The Source by dialing a toll-free number, then hooking your phone to your computer via a modem.

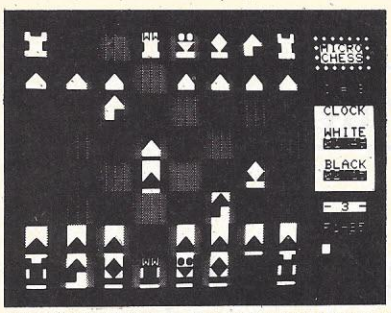
For more information contact Telecomputing Corporation of America, 1616 Anderson Road, McLean, VA 22102; (703) 821-6660.

Jade Computer Products offers a new computer called the Piggy. In their literature, the company explained this rather unusual name for a computer — they "wanted a name that would convey the idea that this computer was really down-to-earth and tough and cute and rugged all at the same time."

Piggy is available in several configurations. The mainframe alone costs $475. A minimum Disk System, including one disk, 24K Expandoram, keyboard, monitor and other features, costs $2295. A Word Processing System, including 32K Expandoram, two disk drives and Electric Pencil software plus other features, costs $2895; with Qume KSR Printer, the same configuration sells for $5795. Jade's address is 4901 West Rosecrans, Hawthorne, CA 90250; (213) 679-3313.

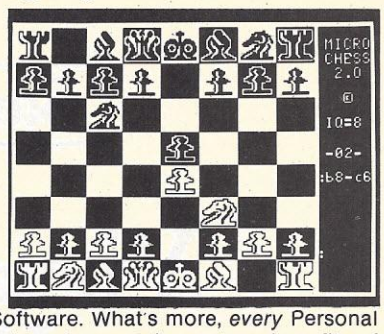
Speakeasy, a company that sells TRS-80 and Apple software, offers a new line of Vitafacts programs. These cassettes, which sell for $19.95 each, give computer-assisted instruction in a number of areas. Cassette titles include: Growing Up (Adolescence), Teenage Drinking and Drugs, Birth Control, Your Blood Pressure, Talking About Sex, and Heart Attacks. Contact Speakeasy, Box 909, Kemptville, Ontario, Canada K0G 1J0. □

PET / TRS-80 / APPLE: Personal Software brings you the finest!

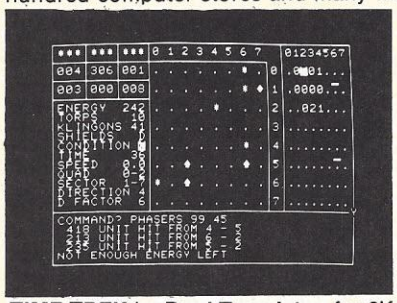


MICRO CHESS

The Industry's First Gold Cassette Over 50,000 Sold

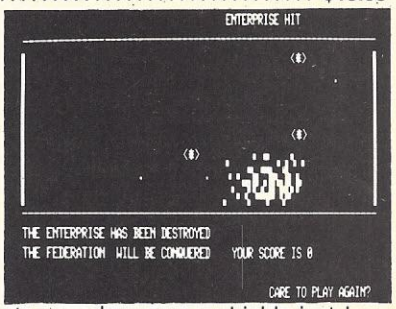


MICROCHESS is the industry's best selling computer game. And no wonder—because MICROCHESS gives you more than just a chessplaying program: A convenient, foolproof set of commands and error checks ... complete instructions in a 5½" by 8½" booklet ... a cassette that's guaranteed to load, with disk versions coming soon ... and several levels of difficulty to challenge you not just once, but time after time. It's available through well over three hundred computer stores and many mail order sources ... always originating from Personal Software. What's more, *every* Personal Software product is selected to give you these same benefits of easy availability, reliable cassettes, readable documentation, a carefully thought out user interface ... and most important, continuing challenge and enjoyment, not just once but time after time. If you haven't already, order your own gold cassette: MICROCHESS, by **Peter Jennings**, for 8K **PET**s, 16K **APPLE**s, and 4K Level I and II **TRS-80**s **$19.95**

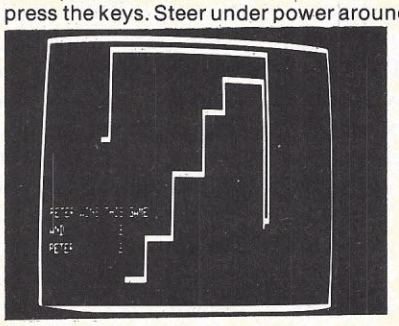


TIME TREK

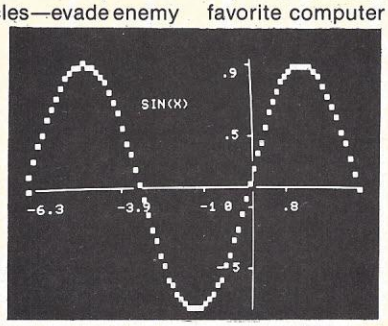
A Tour De Force In Real Time Action Strategy Games



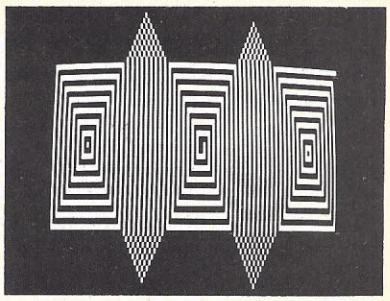
TIME TREK by **Brad Templeton** for 8K **PET**s and **Joshua Lavinsky** for 4K Level I and II **TRS-80**s adds a dramatic new dimension to the classic Star Trek type strategy game: REAL TIME ACTION! You'll need fast reflexes as well as sharp wits to win in this constantly changing game. Be prepared—the Klingons will fire at you as you move, and will move themselves at the same time, even from quadrant to quadrant—but with practice you can change course and speed, aim and fire in one smooth motion, as fast as you can press the keys. Steer under power around obstacles—evade enemy shots as they come towards you—lower your shields just long enough to fire your phasers, betting that you can get them back up in time! With nine levels of difficulty, this challenging game is easy to learn, yet takes most users months of play to master. ADD SOUND EFFECTS with a simple two-wire hookup to any audio amplifier; the TRS-80 also produces sound effects directly through the keyboard case, to accompany spectacular graphics explosions! You won't want to miss this memorable version of a favorite computer game **$14.95**



BLOCKADE by **Ken Anderson** for 4K Level I and II **TRS-80**s is a real time action game for two players, with high speed graphics in machine language. Each player uses four keys to control the direction of a moving wall. Try to force your opponent into a collision without running into a wall yourself! A strategy game at lower speeds, BLOCKADE turns into a tense game of reflexes and coordination at faster rates. Play on a flat or spherical course at any of ten different speeds. You can hear SOUND EFFECTS through a nearby AM radio—expect some razzing if you lose! **14.95**



GRAPHICS PACKAGE by **Dan Fylstra** for 8K **PET**s includes programs for the most common 'practical' graphics applications: PLOTTER graphs both functions and data to a resolution of 80 by 50 points, with automatic scaling and labeling of the axes; BARPLOT produces horizontal and vertical, segmented and labeled bar graphs; LETTER displays messages in large block letters, using any alphanumeric or special character on the PET keyboard; and DOODLER can be used to create arbitrary screen patterns and save them on cassette or in a BASIC program **$14.95**



ELECTRIC PAINTBRUSH by **Ken Anderson** for 4K Level I and II **TRS-80**s: Create dazzling real time graphics displays at speeds far beyond BASIC, by writing 'programs' consisting of simple graphics commands for a machine language interpreter. Commands let you draw lines, turn corners, change white to black, repeat previous steps, or call other programs. The ELECTRIC PAINTBRUSH manual shows you how to create a variety of fascinating artistic patterns including the one pictured. Show your friends some special effects they've never seen on a TV screen! **$14.95**

WHERE TO GET IT: *Look for the* ***Personal Software***™ *display rack at your local computer store. If you can't find the product you want, you can order direct with your VISA/Master Charge card by dialing* ***1-800-325-6400*** *toll free (24 hours, 7 days; in Missouri, dial 1-800-3426600). If you have questions, please call* **408-745-7841**. *Or you can mail your order to the address below.*

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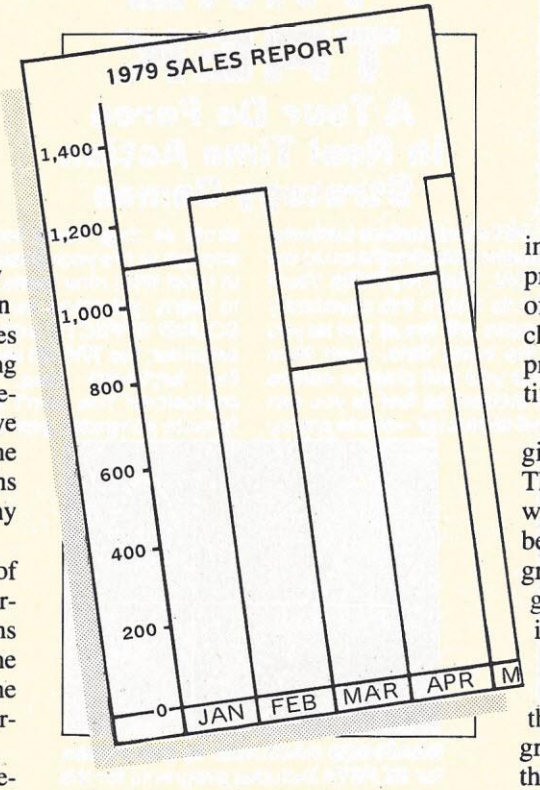
CIRCLE 14

Bar Graphs and Histograms

Visual Aids for Business, Home and School

BY JAMES W. CERNY



Your first exposure to bar charts and graphs probably goes back to early grade-school. Remember the bulletin boards holding lists of pupils' names with stars next to them representing completed papers, or days of good behavior? Besides serving as a positive reinforcement for the students, the graphs were a quick visual aid. Graphs can be used to visually represent many other kinds of information.

The basic feature of these types of graphs is the bar or line drawn proportionate in length to the number of items in a category, or proportionate to the occurrence frequency of a value. The bars can run either horizontally or vertically.

The term "bar graph" is best reserved for plots representing data that are inherently in a limited number of categories or ranks. Examples used in this article include kinds of canned goods and records of game-playing teams. "Histogram" is reserved for graphs that represent data which are logically or in principle continuously varying, though adjacent values may be grouped or partitioned into categories to simplify the pattern. The monthly income example in Sample Run 3 could be considered a histogram, but an even better example would involve the ages or heights for a group of people.

Both bar graphs and histograms have been in use since the 1700s and are basic tools of statistical presentations today. Almost every large package of programs for statistical analysis includes a histogram routine. However, these package routines usually assume that you do not know the frequencies or totals beforehand and expect to calculate them from a larger quantity of individual pieces of data. QHIST, a simple program for "quickie histograms", will make a bar graph or histogram assuming you already know the frequencies or totals that you want graphed.

QHIST is written in a standard version of BASIC. Note, however, that the TAB function is used for spacing; if that function is unavailable in your BASIC, replace it with a loop to print the required number of blanks. Comments inserted in the program clarify what the program is doing at each point. Much of the program is devoted to error checking of the input — to make the program idiot-proof, or, in less pejorative terms, to make it robust.

While not fancy, the QHIST graphs give a quick visual grasp of the data. They can be made more elegant if you wish and the arbitrary limitations can be expanded. For example, the program assumes you will not attempt to graph more than 100 pairs of category identification values and corresponding frequencies. The category identification values must be numbered in the range 0 through 9999. The program asks for the category limits, though the frequency entered for a category may be as large as your computer will allow. Any frequencies in the specified range of categories that are not explicitly entered will be treated as zero. The bars are limited in length to 65 characters (asterisks). If one or more of the frequencies exceeds 65, which is quite likely, QHIST sets the maximum frequency entered to 65 and scales all the others proportionately. Sample Runs 1,2 and 3 demonstrate the program capabilities and possible areas of application.

In Sample Run 1, the won-lost figures for teams in an imaginary wumpus-playing league are entered. For each team (say, the Puce Wumps and the Chartreuse Wumps) three bars

are drawn: games won, games lost and a "blank" separator bar. Because the separators represent frequencies of zero, it was not necessary to explicitly enter any values for them.

Sample Run 2 shows an inventory for canned goods on hand at home. If you let 1=tomato soup, 2=tuna fish, 3=peas and 4=other, then you have to enter four numbers. Several different kinds of mistakes were deliberately made to show that the program is forgiving.

Sample Run 3 demonstrates how a business could graph its income. If the months were numbered consecutively since the business was started in January 1977, then the months for the year 1978 are numbers 13 through 24. The seasonal trend of the business clearly shows in the graph.

By now you've probably thought up your own applications or minor extensions for the program. □

Sample Run 1

```
PROGRAM QHIST.

DO YOU WANT AN EXPLANATION? (YES OR NO)
 ?NO


ENTER A TITLE FOR THE PLOT (UP TO 72 CHARS).
 ?WON-LOST RECORDS FOR WUMPUS LEAGUE TEAMS

ENTER MINIMUM AND MAXIMUM:
 ?1,6

ENTER NO. OF VALUES YOU WILL SPECIFY:
 ?4

ENTER VALUE AND FREQUENCY:
V,F -- ?1,15
V,F -- ?2,4
V,F -- ?4,23
V,F -- ?5,7

CHANGES? (YES OR NO)
 ?NO


WON-LOST RECORDS FOR WUMPUS LEAGUE TEAMS

 1    .***************
 2    .****
 3    .
 4    .***********************
 5    .*******
 6    .

DO YOU WANT ANOTHER HISTOGRAM? (YES OR NO)
 ?YES
```

Sample Run 2

```
ENTER A TITLE FOR THE PLOT (UP TO 72 CHARS).
 ?HOUSEHOLD CANNED GOODS INVENTORY 16-FEB-79

ENTER MINIMUM AND MAXIMUM:
 ?4,1
>>> MINIMUM IS LARGER THAN MAXIMUM...REENTER <<<
ENTER MINIMUM AND MAXIMUM:
 ?1,4

ENTER NO. OF VALUES YOU WILL SPECIFY:
 ?40
>>> THAT EXCEEDS THE RANGE...REENTER <<<
ENTER NO. OF VALUES YOU WILL SPECIFY:
 ?4

ENTER VALUE AND FREQUENCY:
V,F -- ?4,9
V,F -- ?2,2
V,F -- ?1,15
V,F -- ?3,7

CHANGES? (YES OR NO)
 ?YES
ENTER VALUE AND FREQUENCY TO CHANGE.
V,F -- ?4,19

CHANGES? (YES OR NO)
 ?NO

HOUSEHOLD CANNED GOODS INVENTORY 16-FEB-79

 1    .***************
 2    .**
 3    .*******
 4    .*******************

DO YOU WANT ANOTHER HISTOGRAM? (YES OR NO)
 ?YES
```

Sample Run 3

```
ENTER A TITLE FOR THE PLOT (UP TO 72 CHARS).
 ?GROSS 1978 (MONTHS 13-24) RECEIPTS--SKIERS' PARADISE CHALET

ENTER MINIMUM AND MAXIMUM:
 ?13,24

ENTER NO. OF VALUES YOU WILL SPECIFY:
 ?12

ENTER VALUE AND FREQUENCY:
V,F -- ?13,15800
V,F -- ?14,14200
V,F -- ?15,13700
V,F -- ?16,9800
V,F -- ?17,7600
V,F -- ?18,5700
V,F -- ?19,6300
V,F -- ?20,5100
V,F -- ?21,4800
V,F -- ?22,7500
V,F -- ?23,8800
V,F -- ?24,12700
```

Sample Run 3 continued

```
CHANGES? (YES OR NO)
 ?NO

>>> NOTE, HISTOGRAM BARS HAVE BEEN SCALED. <<<


GROSS 1978 (MONTHS 13-24) RECEIPTS--SKIERS' PARADISE CHALET

 13  .************************************************************
 14  .**********************************************************
 15  .********************************************************
 16  .****************************************
 17  .******************************
 18  .************************
 19  .*************************
 20  .********************
 21  .******************
 22  .*****************************
 23  .**********************************
 24  .************************************************

DO YOU WANT ANOTHER HISTOGRAM? (YES OR NO)
 ?NO
```

Program Listing

```
1000 REM ************************************************************
1010 REM PROGRAM QHIST.BAS
1020 REM PROGRAM QHIST MAKES A QUICKIE-HISTOGRAM OR BAR GRAPH,
1030 REM ASSUMING THE USER ALREADY HAS THE FREQUENCY COUNTS AND
1040 REM JUST WISHES TO PLOT THOSE FREQUENCIES.
1050 REM
1060 REM JAMES W. CERNY
1070 REM OFFICE OF ACADEMIC COMPUTING
1080 REM UNIVERSITY OF NEW HAMPSHIRE
1090 REM DURHAM, NEW HAMPSHIRE 03824
1100 REM FEBRUARY 1979
1110 REM ************************************************************
1120 DIM X(100)
1130 N1=100
1140 L=65
1150 REM N1 HOLDS THE ALLOWED DIMENSION OF ARRAY X.
1160 REM L IS MAXIMUM BAR LENGTH (ASSUMES RIGHT MARGIN=72).
1170 PRINT "PROGRAM QHIST."
1180 PRINT
1190 PRINT "DO YOU WANT AN EXPLANATION? (YES OR NO)"
1200 INPUT A$
1210 IF A$="NO" GO TO 1540
1220 PRINT
1230 PRINT "............................................................"
1240 PRINT "THIS PROGRAM ASSUMES YOU ALREADY HAVE YOUR FREQUENCY"
1250 PRINT "COUNTS AND JUST PLOTS A SIMPLE HISTOGRAM FROM THEM."
1260 PRINT
1270 PRINT "YOU WILL BE ASKED TO SPECIFY:  A TITLE, THE RANGE OF"
1280 PRINT "VALUES, THE NUMBER OF FREQUENCIES IN THAT RANGE"
1290 PRINT "THAT YOU WILL ENTER, AND THEN PAIRS OF VALUES AND "
1300 PRINT "CORRESPONDING FREQUENCIES.  ANY VALUES IN THE RANGE"
1310 PRINT "THAT ARE NOT EXPLICITLY ENTERED WILL BE ASSIGNED A"
1320 PRINT "FREQUENCY OF ZERO."
1330 PRINT
1340 PRINT "THE FOLLOWING LIMITATIONS AND RESTRICTIONS APPLY:"
```

Program Listing continued

```
1350 PRINT "    1. ONLY INTEGER VALUES ARE ALLOWED."
1360 PRINT "    2. VALUES MAY NOT EXCEED 4 DIGITS, INCLUDING"
1370 PRINT "       A MINUS SIGN."
1380 PRINT "    3. THE RANGE MAY NOT EXCEED 100."
1390 PRINT "       THIS IS ARBITRARY AND CAN BE INCREASED BY"
1400 PRINT "       CHANGING LINES 170 AND 180 IN THE PROGRAM."
1410 PRINT "    4. NO FREQUENCY BAR MAY EXCEED 65."
1420 PRINT "       IF ONE OR MORE OBSERVED FREQUENCIES EXCEED"
1430 PRINT "       65, THE PROGRAM WILL RESCALE ALL FREQUENCIES"
1440 PRINT "       SO THAT THE LARGEST ONE HAS A FREQUENCY BAR"
1450 PRINT "       OF 65."
1460 PRINT
1470 PRINT "THE PROGRAM IS ROBUST, YET FORGIVING; MOST ERRORS LEAD"
1480 PRINT "TO A WARNING MESSAGE AND A CHANCE TO MAKE A CORRECTION."
1490 PRINT "HOWEVER, IF YOU MISCOUNT AND TELL THE PROGRAM THAT YOU"
1500 PRINT "WILL ENTER MORE VALUE-FREQUENCY PAIRS THAN YOU REALLY"
1510 PRINT "INTEND TO, JUST REPEAT EARLIER VALUE-FREQUENCY PAIRS"
1520 PRINT "UNTIL THE PROGRAM IS SATISFIED."
1530 PRINT "....................................................."
1540 PRINT
1550 PRINT
1560 FOR I=1 TO N1
1570 X(I)=0.0
1580 NEXT I
1590 REM *
1600 REM *
1610 REM ************************************************************
1620 REM ***** BEGIN PRELIMINARY DESCRIPTION OF HISTOGRAM REQUEST.
1630 REM ************************************************************
1640 REM *
1650 REM *
1660 PRINT "ENTER A TITLE FOR THE PLOT (UP TO 72 CHARS)."
1670 INPUT T$
1680 PRINT
1690 PRINT "ENTER MINIMUM AND MAXIMUM:"
1700 INPUT B,A
1710 IF A>=B GO TO 1740
1720 PRINT ">>> MINIMUM IS LARGER THAN MAXIMUM...REENTER <<<"
1730 GO TO 1690
1740 C=A-B+1
1750 REM B=MINIMUM; A=MAXIMUM; C=RANGE, INCL. THE EXTREMES.
1760 IF C<=N1 GO TO 1790
1770 PRINT ">>> RANGE TOO LARGE...REENTER <<<"
1780 GO TO 1690
1790 PRINT
1800 PRINT "ENTER NO. OF VALUES YOU WILL SPECIFY:"
1810 INPUT N
1820 IF N>0 GO TO 1850
1830 PRINT ">>> YOU MUST SPECIFY AT LEAST 1 VALUE...REENTER <<<"
1840 GO TO 1800
1850 IF N<=N1 GO TO 1880
1860 PRINT ">>> NO MORE THAN ";N1;" VALUES ALLOWED...REENTER <<<"
1870 GO TO 1800
1880 IF N<=C GO TO 2000
1890 PRINT ">>> THAT EXCEEDS THE RANGE...REENTER <<<"
1900 GO TO 1800
1910 REM *
1920 REM *
1930 REM ************************************************************
1940 REM ***** END PRELIMINARY DESCRIPTION AND
1950 REM ***** BEGIN VALUES ENTERING AND CHECKING LOOP.
1960 REM ************************************************************
1970 REM *
1980 REM *
1990 REM W IS A FLAG AND VALUE HOLDER FOR SCALING.
2000 W=0
2010 PRINT
2020 PRINT "ENTER VALUE AND FREQUENCY:"
2030 FOR I=1 TO N
2040 GOSUB 2610
2050 NEXT I
2060 PRINT
2070 PRINT "CHANGES? (YES OR NO)"
2080 INPUT A$
2090 IF A$="NO" GO TO 2140
2100 PRINT "ENTER VALUE AND FREQUENCY TO CHANGE."
2110 GOSUB 2610
```

Program Listing continued

```
2120 GO TO 2060
2130 REM SCALE IF NECESSARY; S IS THE SCALE FACTOR.
2140 IF W=0 GO TO 2290
2150 S=L/W
2160 FOR I=1 TO C
2170 X(I)=X(I)*S
2180 NEXT I
2190 REM *
2200 REM *
2210 REM ************************************************************
2220 REM ***** END VALUES ENTERING AND CHECKING LOOP AND
2230 REM ***** BEGIN PRINTING HISTOGRAM.
2240 REM ************************************************************
2250 REM *
2260 REM *
2270 PRINT
2280 PRINT ">>> NOTE, HISTOGRAM BARS HAVE BEEN SCALED. <<<"
2290 PRINT
2300 PRINT
2310 PRINT
2320 PRINT T$
2330 PRINT
2340 I0=B-1
2350 FOR I=1 TO C
2360 K=X(I)
2370 I0=I0+1
2380 PRINT I0;
2390 PRINT TAB(5);".";
2400 IF K=0 GO TO 2440
2410 FOR J=1 TO K
2420 PRINT "*";
2430 NEXT J
2440 PRINT " "
2450 NEXT I
2460 PRINT
2470 PRINT
2480 PRINT
2490 GO TO 2840
2500 REM *
2510 REM *
2520 REM ************************************************************
2530 REM ***** FINISH PRINTING HISTOGRAM AND BRANCH AROUND
2540 REM ***** SUBROUTINE.
2550 REM ***** THIS SUBROUTINE DETERMINES WHETHER VALUE (V) IS WITHIN
2560 REM ***** THE RANGE AND WHETHER THE FREQUENCY (F) WILL REQUIRE
2570 REM ***** SCALING TO BE DONE.
2580 REM ************************************************************
2590 REM *
2600 REM *
2610 PRINT "V,F --";
2620 INPUT V,F
2630 IF F<=L GO TO 2680
2640 IF W>F GO TO 2680
2650 W=F
2660 REM CALCULATE SUBSCRIPT FOR PLACE TO STORE V IN ARRAY X.
2670 REM FIRST CHECK ON SIZE OF V.
2680 IF V<=A GO TO 2710
2690 PRINT ">>> VALUE TOO LARGE...REENTER <<<"
2700 GO TO 2610
2710 IF V>=B GO TO 2740
2720 PRINT ">>> VALUE TOO SMALL...REENTER <<<"
2730 GO TO 2610
2740 I1=V-B+1
2750 X(I1)=F
2760 RETURN
2770 REM *
2780 REM *
2790 REM ************************************************
2800 REM ***** END OF SUBROUTINE.
2810 REM ************************************************
2820 REM *
2830 REM *
2840 PRINT "DO YOU WANT ANOTHER HISTOGRAM? (YES OR NO)"
2850 INPUT A$
2860 IF A$="YES" GO TO 1540
2870 STOP
2880 END
```

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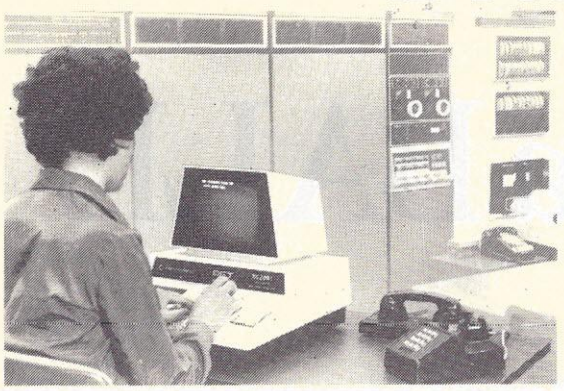

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CIRCLE 15

BASIC Assembly Language Loader

Let's Have a BALL

BY ROD HALLEN

You've just come across an interesting assembly language program and you'd like to try it out. Unfortunately, the machine coding is in Octal and your computer programs in Hex. What would you do?

1. Get out a pencil and paper, do the Octal to Hex conversion and enter the program?

2. Use a number base conversion calculator such as TI's Programmer and then enter the program?

3. Write a software number base converter, do the conversion and then enter the program?

4. Or forget the whole thing?

I don't know what your answer is, but in the year and a half I've had my SOL, I've always leaned toward solution number four. I am especially reluctant to take the time to convert Octal to Hex when I find a routine that is more than a couple of hundred bytes long. I have undoubtedly missed some very good programs that way.

Recently, I wanted to check the coding of a disk operating system a friend had written and possibly modify it to fit the SOL. Although this system is written in Octal and is almost 4K in length, I decided to tackle it anyway. First I wrote a routine that converts between the Decimal, Octal and Hex number bases. This was helpful but it still required a lot of hand work.

However, before I reveal how I solved my problem, let's take a look at number base conversion and the converter routine I came up with. Program A is a listing written in Processor Technology's Extended Cassette BASIC. While I enjoy assembly language programming, I find I can write and debug complex programs easier and faster in BASIC.

Figure 1 is a sample run of Program A. Note that you're asked for the base (D, O or H) of the numbers that you intend to enter. Then you're asked for a number and the other two base equivalents are printed. You are given a chance to change your base if you enter 0 when asked for a number. If you input 0 for the base, the program ends.

Table 1 lists the variables from Program A and what they represent. I think a list such as this makes it easier to read a program. Whenever I want to troubleshoot or modify a BASIC program that someone else has written, I first go through it and attempt to determine what the variables are doing.

While the following description may be old stuff to experienced progammers, those of you who are new at this game might want to step through the number base converter with me line by line and see if we can figure out how it works. Lines 10 to 40 are for my information. Line 30 tells me the tape number, name and recorder counter setting that was used to store this program.

Line 50 dimensions and loads a string variable (A$) with all of the Octal and Hex characters, line 60 clears the screen and homes the cursor, and Line 70 prints a title. Lines 80 to 260 are the body of the program. You are asked for a base, routed to the appropriate subroutine, asked for a number, and upon return to the main program, the equivalents are printed. Line 90 will END the program if 0 is entered for the base. The loop in line 100 allows you to input up to 100 numbers for each base but any value that suits you can go here.

Some peculiarities of PT's Extended BASIC may need clarifying. The (1,0)

Table 1

A$ - Hex and Octal digit storage	K - Loop to step through number
H$ - INPUT Hex number	M - Array to store digit weights
N$ - INPUT base	Q6 - Octal digit six
Q$ - INPUT Octal number	Q5 - " " five
D - INPUT Decimal number	Q4 - " " four
H4 - Hex digit four	Q3 - " " three
H3 - " " three	Q2 - " " two
H2 - " " two	Q1 - " " one
H1 - " " one	Z - Length of INPUT number
J - Loop to compare digits with A$	

A listing of the variables used in Program A and what they do.

after INPUT in Line 80 means that an automatic carriage return will be performed after one character has been entered. In other words, as soon as you hit D, O, H or 0, the INPUT is finished and the program goes on to the next statement. Leave it out if it doesn't work. Multiple statements are allowed after the IF...THEN as in line 110. If the IF part is true then all statements following the THEN are worked; otherwise none are.

If we enter a D at Line 80, we will be routed to line 270, which is our Decimal to Hex subroutine. Line 280 asks for a number, line 290 goes back for a new base if we enter 0, and lines 300 to 330 determine the value of each Hex digit (0 to 15) mathematically. Lines 360 to 410 do the same for the Octal digits except that each has a value from 0 to 7. If we were to print H4 to H1 and Q6 to Q1 at this point, we'd get decimal numbers in the range 0 to 15 and 0 to 7 for each Hex or Octal digit. Now we return to the main program which uses these decimal numbers to pull the Hex and Octal equivalents out of A$ for printing.

How about an example? If we INPUT D and 64321, we would return from Line 420 to the main program as follows: H4=15, H3=11, H2=4, H1=1, Q6=1, Q5=7, Q4=5, Q3=5, Q2=0 and Q1=1. Lines 150 to 230 would print: DECIMAL 64321 = OCTAL 175501 = HEX FB41. The IF in lines 150, 170 and 200 will eliminate printing the number we originally INPUT. After we've INPUT a number we don't need to print it again.

PT's BASIC uses a different string arrangement than many other BASICs. PRINT A$(H4+1,H4+1) means to print the characters in A$ that are stored between positions H4+1 and H4+1. Since H4=15, the 16th character (15+1) or F will be printed. If two different numbers were specified (for instance, PRINT A$(1,4)) then all of the characters in A$ between positions 1 and 4 would be printed.

Now, if we had INPUT O for the base, we would have gone to line 540 for the Octal to Decimal subroutine. We are asked for a number and if it's 0 we go back for a new base. Line 570 determines how many digits are in the Octal number and makes sure that the read statement in line 590 uses the Octal digit weights stored in line 660. See Table 2. Lines 580 to 640 step through the Octal number, multiplying the decimal weight for each digit position times the digit in that position. Review Table 2 if that still isn't clear.

Table 2

Octal weights

Position	6	5	4	3	2
weight	32768	4096	512	64	8

Hex weights

Position	4	3	2	1
weight	4096	256	16	1

Decimal weights

Position	5	4	3	2	1
weight	10000	1000	100	10	1

Hex digits

A = 10, B = 11, C = 12, D = 13, E = 14, and F = 15.

Octal, Hex, and Decimal digit position weights. Each digit of a number is multiplied by its position weight to get its position value and then all of the position values are added together to get its total Decimal value. Examples: 1357 Octal equals 751 Decimal because (1 × 512) + (3 × 64) + (5 × 8) + (7 × 1) = 751 and C905 Hex equals 51461 Decimal because (12 × 4096) + (9 × 256) + (0 × 16) + (5 × 1) = 51641. Since Hex digits can not be used directly in mathematical problems, their Decimal equivalents are given at the bottom of the table. Note the Decimal digit position weights. We are so used to these that we do this conversion automatically.

At line 630 we add the Decimal value of each position to D. When we have stepped all the way through the number, we have the Decimal equivalent to the Octal number that we started with. Now we go to line 300 to find the Hex equivalent. We do this by dividing the Decimal number by each of the Hex digit position weights. Since B=3 we RETURN at line 350.

Finally, if we entered H for the base, we go to line 430. After asking for a number and checking to see if it's 0, the number of digits is determined and our READ pointer is RESTOREd to the correct table of digit weights (line 650). The Decimal value of each Hex digit is figured by multiplying the Hex digit weight by the Hex digit in each position. Line 520 sums all of the digits and line 530 goes to line 360, to find the Octal equivalent, with D equal to the Decimal number.

No matter which base we started from, we will return to 140 with D equal to the decimal number; H4, H3, H2 and H1 equal to the Hex digits; and Q6, Q5, Q4, Q3, Q2 and Q1 equal to the Octal digits. If D exceeds 65535, we get the error message and go back for another try. If D is within range, we are now ready to print the result.

D prints directly but the H and Q values are used to pull the appropriate digits out of A$ as mentioned before. The Octal digits could have been printed directly; but some quirk in my BASIC kept putting spaces between the digits even though I was using a semicolon as a separator. For interpreters with true string arrays and other features, see Program B for some suggestions to make this fit your machine.

Let's get back to the main subject. I started out trying to find a way to load Octal assembly language programs into my Hex-speaking computer. Writing the software we've just been discussing was educational and interesting. It's a very useful routine, but still not what I was looking for. After converting an Octal number to Hex and printing the result, I still had to enter the Hex code by hand.

Why not write a progam that converted from Octal to Hex (or Hex to Octal) and then entered the result in the proper address location? I sat down with my sharpened pencil and it turned out to be easier than the number base converter. First off, we are only dealing with a number whose maximum value is 255. Then, too, maybe all of that number conversion experience paid off.

Program C is the result of my sharp pencil. It's written in PT's Extended BASIC, will accept either Octal or Hex input and places the machine code in memory for you. From now on, whenever I mention "AL program", I am referring to an assembly language program written in Octal that you want to load into your Hex machine, or vice versa if you have an Octal-speaking computer. A compromise had to be

made to take care of one problem I came up against, but the program is still very easy to utilize.

The problem relates to the fact that most assembly language programs are written for location at 0000 or some other address at the low end of the memory spectrum. If you were using Program C to load an AL program at 0000, it would byte by byte replace your BASIC which also starts at 0000. In other words Program C would be destroying the interpreter that supports it.

After much thought, I decided to load the assembly language code at a temporary location where it wouldn't disturb BASIC and then move it to its proper place after I was through with BASIC. All of this is done more or less automatically.

Look at Program C and follow along. Table 3 is a list of variables. The first four lines are info lines as in Progam A. I have a very poor memory and need lots of help. I can write a program and three months later won't remember what it was intended to do. After clearing the screen (line 50), printing a title (line 60) and setting up A$ (line 70) as in Program A, we're ready to start.

Line 80 asks where you want to start loading the assembly language program. This must be some location that will not interfere with BASIC. I have two 16K boards and use 7000 to 7FFF Hex as a temporary location, which is 4K and usually enough. Line 80 wants its input in decimal and 7000 Hex is 28672 Decimal. If I had included more of Progam A, you could have answered this question in any base; but that seemed like an unnecessary complication. You'll probably always use the same temporary location and will only have to figure it out once.

Line 90 asks for the base you'll be inputing code in, O for Octal or H for Hex, and line 100 sets up a branch determined by this input. Lines 110 to 200 are the main program. These lines will ask for a machine code, GOSUB to the approriate conversion subroutine at line 250 or 330, and return to line 170 with D equal to the Decimal equivalent of the INPUT. Line 170 will determine the desired address and POKE D there.

The smaller N loop, lines 130 to 180, is to allow 16 INPUTs per screen line. Even though 16 codes appear on each line, a carriage return is still needed after the entry of each code. Lines 130 and 180 could be eliminated, the STEP 16 removed from line 110, the first comma removed from line 140, and line 170 changed to POKE S+I,D. INPUTs would then print down the left margin of the screen. The larger I loop, lines 100 to 200, will load 1K bytes but can, of course, be changed.

Table 3

A$ - Hex and Octal digit storage	K - Loop to step through a number
B$ - INPUT base	L - Loop to read AL MOVER
C$ - INPUT machine code	M - Array to store digit weights
Y$ - YES or NO INPUT	N - Per line number INPUT loop
B - Base	P - Start address of AL MOVER
D - Decimal result	R - Loop to POKE machine code
I - INPUT loop total	S - Loader start address
J - Loop to compare digits to A$	X - Satisfys CALL function

A list of variables used in Program C.

The subroutine at line 330 is a very simple two-digit Hex to Decimal converter. Only two digits need to be translated since that is all one eight bit byte (00 to FF) will hold. The Octal subroutine at line 250 will convert three digits (000 to 377).

When the entire AL program has been entered, ZZ is INPUT, detected by line 150, and a jump to line 210 is made. Since the program we've loaded is now being held in a temporary storage location, line 220 asks if you want

Program A

```
10 REM-DECIMAL-OCTAL-HEX NUMBER CONVERSION
20 REM-ROD HALLEN TOMBSTONE, AZ  23 JUNE 1978
30 REM-TAPE #1 SIDE #2  "DOHNC"  00-> REVISED 25 JULY 1978
40 REM-WRITTEN IN PROCESSOR TECHNOLOGY'S EXTENDED CASSETTE BASIC
50 DIM A$(16): LET A$="0123456789ABCDEF"
60 PRINT CHR(11): PRINT
70 PRINT TAB(12);"DECIMAL-OCTAL-HEX NUMBER CONVERTER": PRINT
80 PRINT : INPUT (1,0)"BASE ? ",N$: PRINT
90 IF N$="0" THEN  END
100 FOR I=1 TO 100: LET D=0
110   IF N$="D" THEN  LET B=1: GOSUB 270
120   IF N$="H" THEN  LET B=2: GOSUB 430
130   IF N$="O" THEN  LET B=3: GOSUB 540
140   IF D>65535 THEN  PRINT "NUMBER EXCEEDS 65,535.": GOTO 240
150   IF B=1 THEN  GOTO 170
160   PRINT " = DECIMAL ";D;
170   IF B=2 THEN  GOTO 200
180   PRINT " = HEX ";A$(H4+1,H4+1);A$(H3+1,H3+1);
190   PRINT A$(H2+1,H2+1);A$(H1+1,H1+1);
200   IF B=3 THEN  GOTO 240
210   PRINT " = OCTAL ";
220   PRINT A$(Q6+1,Q6+1);A$(Q5+1,Q5+1);A$(Q4+1,Q4+1);
230   PRINT A$(Q3+1,Q3+1);A$(Q2+1,Q2+1);A$(Q1+1,Q1+1);
240   PRINT : PRINT
250 NEXT I
260 END
270 REM-DECIMAL TO HEX SUBROUTINE
280 INPUT ,"DECIMAL NUMBER ? ",D
290 IF D=0 THEN  PRINT : GOTO 80
300 LET H4=INT(D/4096)
310 LET H3=INT((D-H4*4096)/256)
320 LET H2=INT((D-((H4*4096)+(H3*256)))/16)
330 LET H1=D-((H4*4096)+(H3*256)+(H2*16))
340 REM-DECIMAL TO OCTAL SUBROUTINE
350 IF B=3 THEN  RETURN
360 LET Q6=INT(D/32768)
370 LET Q5=INT((D-Q6*32768)/4096)
380 LET Q4=INT((D-((Q6*32768)+(Q5*4096)))/512)
390 LET Q3=INT((D-((Q6*32768)+(Q5*4096)+(Q4*512)))/64)
400 LET Q2=INT((D-((Q6*32768)+(Q5*4096)+(Q4*512)+(Q3*64)))/8)
410 LET Q1=D-((Q6*32768)+(Q5*4096)+(Q4*512)+(Q3*64)+(Q2*8))
420 RETURN
430 REM-HEX TO DECIMAL SUBROUTINE
440 INPUT ,"HEX NUMBER ? ",H$
450 IF H$="0" THEN  PRINT : GOTO 80
460 LET Z=LEN(H$): RESTORE
470 FOR K=Z TO 1 STEP -1
480   READ M(K)
```

Program A continued

```
490   FOR J=1 TO 16
500     IF H$(K,K)=A$(J,J) THEN  LET X=J-1: LET J=16
510   NEXT J
520   LET D=D+X*M(K)
530 NEXT K: GOTO 360
540 REM-OCTAL TO DECIMAL SUBROUTINE
550 INPUT ,"OCTAL NUMBER ? ",Q$
560 IF Q$="0" THEN  PRINT : GOTO 80
570 LET Z=LEN(Q$): RESTORE 660
580 FOR K=Z TO 1 STEP -1
590   READ M(K)
600   FOR J=1 TO 8
610     IF Q$(K,K)=A$(J,J) THEN  LET X=J-1: LET J=8
620   NEXT J
630   LET D=D+X*M(K)
640 NEXT K: GOTO 300
650 DATA 1,16,256,4096
660 DATA 1,8,64,512,4096,32768
```

A Decimal - Octal - Hexadecimal Number Converter (DOHNC) written in Processor Technology's Extended Cassette BASIC. See Program B for suggested mods to fit other BASICs.

Program B

```
REPLACE 50 WITH:

50 DIMA$(16)
51 FOR X=1 TO 16
52 READ A$
53 NEXT X
54 DATA 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F


REPLACE 60 WITH:

60 FOR Y=1 TO 16
61 PRINT
62 NEXT Y


REPLACE 160 TO 190 WITH:

160 PRINT A$(Q6); A$(Q5); A$(Q4); A$(Q3); A$9Q2); A$(Q1);
170 PRINT " = HEX "; A$(H4); A$(H3); A$(H2); A$(H1);


REPLACE 570 WITH:

570 LET Z=LEN(Q$)
571 M(6)=1: M(5)=8: M(4)=64: M(3)=512
572 M(2)=4096: M(1)=32768
DELETE 590 AND 660
```

Modifications to Program A for BASICS that can not run it as written.

Program C

```
 10 REM-BASIC HEX OR OCTAL ASSEMBLY LANGUAGE LOADER
 20 REM-ROD HALLEN  TOMBSTONE, AZ  24 JULY 1978
 30 REM-TAPE #1  SIDE #2  "BALL"  20->
 40 REM-WRITTEN IN PROCESSOR TECHNOLOGY'S EXTENDED CASSETTE BASIC
 50 PRINT CHR(11): PRINT
 60 PRINT TAB(10);"HEX OR OCTAL ASSEMBLY LANGUAGE LOADER": PRINT
 70 DIM A$(16): LET A$="0123456789ABCDEF"
 80 INPUT "START OR STORAGE ADDRESS ?  ",S
 90 PRINT : INPUT "BASE ?  ",B$
100 IF B$(1,1)="O" THEN  LET B=1 ELSE  LET B=2
110 FOR I=0 TO 1023 STEP 16
120   PRINT : PRINT "MACHINE CODE ?"
130   FOR N=0 TO 15: LET D=0
140     INPUT ," ",C$
150     IF C$="ZZ" THEN 210
160     IF B=1 THEN  GOSUB 250 ELSE  GOSUB 330
```

to move it. Follow this next part closely because it's a little bit tricky. Program D is the routine that actually does the moving. Program D was written in Hex, as you see it, and loaded into memory starting at C900H — a spare 1K of RAM on the SOL PC board.

We put the address we want to move the AL program *to* into the H register pair (LXI H 00 00), the address we want to move it *from* into the D register pair (LXI D 00 70), and how many bytes it contains into the B register pair (LXI B FF 03). In this case, I want to move it to 0000, it is now located at 7000, and it is 03FF (1K) long.

We move the first byte to the accumulator (LDAX D), then move it to its new location (MOV M A), increment the TO and FROM address (INX H & INX D) and decrement the byte counter (DCX B). Next we zero the accumulator (XRA A) and check to see if the B register pair is zero (CMR B & CMR C); if not, we go back (JNZ LOOP) for another byte. If we are done, we exit to the SOL monitor routine (JMP C004). You can JUMP from here to wherever suits your machine.

This little routine could be entered by hand each time we had a program we'd like to move; but why not let our converter-loader program (C) also do the moving? That's what lines 410 to 510 do.

Line 420 sets up an array (T) and the starting address for the AL Mover (51456 = C900 Hex). Lines 430 to 450 load the DATA in lines 460 and 470 into the T array, all 26 bytes. It might just be starting to dawn on you that the DATA in lines 460 and 470 is program D written in decimal. After each of the bytes of Program D has been loaded into the T array, lines 480 to 500 POKE them starting at C900.

Line 510 is a jump to C900. Our mover program is executed and the AL program we loaded earlier with Program C is moved to 0000. In the process we've wiped out part of BASIC, but we are through with it for the moment anyway. The last step before we run our new AL program is to get it on tape for safe keeping. Then we can reload it at will since it is now loaded and dumped in Hex (or Octal, if your's is an Octal machine). Also, be sure to SAVE Program C before you run it for the first time or you will lose it in the crash.

Let's highlight what's been discussed. First, load BASIC and then Program C. Make any necessary modifications to C and then SAVE it on tape. RUN C and INPUT your Hex or Octal AL program. When it is all entered,

Program C continued

```
170     POKE S+I+N,D
180   NEXT N
190   PRINT
200 NEXT I
210 PRINT : PRINT
220 INPUT "DO YOU WANT TO MOVE THE PROGRAM THAT YOU HAVE JUST LOADED ?  ",Y$
230 IF Y$(1,1)="Y" THEN  GOSUB 410
240 PRINT : END
250 REM-OCTAL TO DECIMAL CONVERSION
260 LET M(1)=64: LET M(2)=8: LET M(3)=1
270 FOR K=1 TO 3
280   FOR J=1 TO 8
290     IF C$(K,K)=A$(J,J) THEN  LET D=D+M(K)*(J-1): LET J=8
300   NEXT J
310 NEXT K
320 RETURN
330 REM-HEX TO DECIMAL CONVERSION
340 LET M(1)=16: LET M(2)=1
350 FOR K=1 TO 2
360   FOR J=1 TO 16
370     IF C$(K,K)=A$(J,J) THEN  LET D=D+M(K)*(J-1): LET J=16
380   NEXT J
390 NEXT K
400 RETURN
410 REM-ASSEMBLY LANGUAGE PROGRAM MOVER
420 DIM T(26): LET P=51456
430 FOR L=1 TO 26
440   READ T(L)
450 NEXT L
460 DATA 33,0,0,17,0,112,1,255,3,26,119,35,19,11
470 DATA 175,184,194,9,201,185,194,9,201,195,4,192
480 FOR R=0 TO 25
490   POKE P+R,T(R+1)
500 NEXT R
510 LET X=CALL(P)
520 RETURN
```

The BASIC Assembly Language Loader (BALL). This will accept Hex or Octal machine code INPUT and place it in either its required location or a temporary storage area. In the latter case, the AL program MOVER subroutine will then move the entire AL program to its proper starting location.

Program D

	ADDRESS	OP CODES	ASSEM LANG	COMMENTS
START	C900	21 00 00	LXI H	TO ADDRESS
	03	11 00 70	LXI D	FROM ADDRESS
	06	01 FF 03	LXI B	TOTAL BYTES
	09	1A	LDAX D	
LOOP	0A	77	MOV M A	
	0B	23	INX H	
	0C	13	INX D	
	0D	0B	DCX B	
	0E	AF	XRA A	
	0F	B8	CMR B	
	10	C2 09 C9	JNZ LOOP	
	13	B9	CMR C	
	14	C2 09 C9	JNZ LOOP	
EXIT	C917	C3 04 C0	JMP MONITOR	

The assembly language MOVER written in Hex. This routine was converted to decimal and placed in Program C as the DATA statements in Lines 460 and 470.

INPUT ZZ. The question "DO YOU WANT TO MOVE THE ASSEMBLY LANGUAGE PROGRAM YOU'VE JUST LOADED?" will appear. If you do, type Y or YES and, when your monitor prompt returns (SOL puts>on the screen), your program is loaded where it belongs. Tape your AL program and you are done.

Figure 2 shows a sample Run of Program C. Note that I entered a string of Octal machine codes and not a real program. After I INPUT ZZ and answered YES to the MOVE question, the prompter (>) returned. Now, to verify that all went well, I DUMP 7000 to 701F, the temporary load location. It looks O.K., so I DUMP 0000 001F, the final load location. It still looks O.K.

Some modifications to get around the idiosyncracies of PT BASIC may be necessary as in Program A. You will also want to modify lines 460 and 470 as required. Rewrite the first three lines of Program D to fit your situation and then convert them to decimal with Program E and enter them in the DATA statements in Program C.

Program E pulls a program out of memory and prints it in Decimal form. Figure 3 is a RUN of Program E and a DUMP of C900 to show the correspondence between the Decimal and Hex codes. Line 60 should reflect the length of the program to be printed. It would read "60 FOR I = 0 to 1023 STEP 16" for a 1K listing.

You should be aware of the BASIC AL Loader's limitations. It will not relocate programs. If you temporarily locate an AL program at 7000 Hex, you cannot run it there if it was designed to run at 0000. If an AL program needs to be patched for I/O routines or otherwise modified, these changes will still be necessary before or after the program has been loaded.

Almost everytime I run some software that I've written, I end up modifying it. Already changes suggest themselves for the programs in this article. A and C could easily be combined, C could count the number of INPUT bytes for the MOVER, E could be added to C, line 150 in C could be rewritten to automatically carriage return after two or three characters had been INPUT, and on and on. . . .

What started out as a problem ended up as a few useful programs. Now you can load those Octal assembly language programs into your Hex machine (or vice versa). Anytime you run into a problem looking for a solution, ask yourself, "Can my micro handle this?" You might be surprised at the answer. □

Figure 1

```
        DECIMAL-OCTAL-HEX NUMBER CONVERTER

BASE ? D

DECIMAL NUMBER ? 65535 = HEX FFFF = OCTAL 177777

DECIMAL NUMBER ? 1023 = HEX 03FF = OCTAL 001777

DECIMAL NUMBER ? 4095 = HEX 0FFF = OCTAL 007777

DECIMAL NUMBER ? 0

BASE ? H

HEX NUMBER ? C900 = DECIMAL  51456 = OCTAL 144400

HEX NUMBER ? C905 = DECIMAL  51461 = OCTAL 144405

HEX NUMBER ? 7000 = DECIMAL  28672 = OCTAL 070000

HEX NUMBER ? 0

BASE ? O

OCTAL NUMBER ? 1357 = DECIMAL  751 = HEX 02EF

OCTAL NUMBER ? 1377 = DECIMAL  767 = HEX 02FF

OCTAL NUMBER ? 137777 = DECIMAL  49151 = HEX BFI

OCTAL NUMBER ? 0

BASE ? 0

READY
```

A sample run of Program A. After a base has been entered, the program will ask for numbers in that base until a 0 is INPUT. The program ends when 0 is INPUT for the base.

Figure 2

```
        HEX OR OCTAL ASSEMBLY LANGUAGE LOADER

START OR STORAGE ADDRESS ?  28672

BASE ?  OCTAL

MACHINE CODE ?
 000 001 002 003 004 005 006 007 010 011 012 013 014 015 016 017

MACHINE CODE ?
 377 376 375 374 373 372 371 370 367 366 365 364 363 362 361 360

MACHINE CODE ?
 ZZ

DO YOU WANT TO MOVE THE PROGRAM THAT YOU HAVE JUST LOADED ?  YES

>

 DUMP 7000 701F

7000  00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
7010  FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0


DUMP 0000 001F

0000  00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
0010  FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0
```

A sample run of Program C. A DUMP of 7000 and 0000 shows that the Octal program we INPUT was first entered at 7000 correctly and then moved to 0000.

Figure 3

```
RUN
 33 0 0 17 0 112 1 255 3 26 119 35 19 11 175 18
 194 9 201 185 194 9 201 195 4 192 0 0 0 0 0 0

DUMP C900 C91F

C900  21 00 00 11 00 70 01 FF 03 1A 77 23 13 0B AF B8
C910  C2 09 C9 B9 C2 09 C9 C3 04 C0 00 00 00 00 00 00
```

A sample run of Program E showing the Decimal result and the Hex code that it came from.

Program E

```
10 REM-ROUTINE TO PULL ASSEMBLY LANGUAGE PROGRAMS
20 REM-AND PRINT THEM IN DECIMAL FORM
30 REM-ROD HALLEN  TOMBSTONE, AZ  25 JULY 1978
40 SET OP=1
50 LET A=51456
60 FOR I=0 TO 31 STEP 16
70   FOR J=0 TO 15
80     LET X=PEEK(A+I+J)
90     PRINT X;
100  NEXT J
110  PRINT
120 NEXT I
130 SET OP=0
140 END
```

This quickly will pull and print in decimal a program which already exists in memory. Lines 40 and 130 turn my printer on and off.

Programs for People on the Move

BY RUSS CONNELL

Paper Routes

Everyday over 2 million paperboys and -girls deliver the news. In fact our family has four paperboys. A constant problem with paper routes is having an up-to-date route list for that substitute or the other brother who helps out with the route. Until we owned a Pet computer, we had to update the list by hand on 3″ × 5″ cards.

You could use extensive files and print formating, but why not try the ROM built-in list and line numbering programs to update and add new customers on a street? Enter the address (last three digits for simplicity) in delivery order per street. Then simply add customers by typing an in-between line. Delete customers on the Pet with the cursor or other item correction means on your computer. Once updated, simply type LIST and presto, out comes your new paper route list!

```
LIST
 10        NEWSPAPER ROUTE
 20             #2356
 30    NOME ST
 40    410  412  414  430  440  445  460
 50    500  510  515  518  520  522  528
 60    560  565  570  580  585
 70    NILE ST
 80    435  440  445  448  490  510  515
 90    520  525  528  530  540  544  548
100    550  555  560  568  570  590
110    NEWARK ST
120    420  425  428  430  432  434  438
130    440  445  448  450  455  458  460
140    465  468  470  475  480


52  530  544


LIST
 10        NEWSPAPER ROUTE
 20             #2356
 30    NOME ST
 40    410  412  414  430  440  445  460
 50    500  510  515  518  520  522  528
 52    530  544
 60    560  565  570  580  585
 70    NILE ST
 80    435  440  445  448  490  510  515
 90    520  525  528  530  540  544  548
100    550  555  560  568  570  590
110    NEWARK ST
120    420  425  428  430  432  434  438
130    440  445  448  450  455  458  460
140    465  468  470  475  480
```

Depending on your computer's diagnostic routine, you may have to enter one set of quotes before typing the street name or address. Remember, don't type RUN, only LIST.

Pacing Runs

The greatest fad to come along in the United States is running. It seems everyone in the neighborhood runs for one reason or another.

Serious runners pace themselves both physically and mentally. To do this you must develop a chart showing anticipated lap or mile times. Secondly, as a serious spectator you may like to predict the runners' final time based on their lap or mile times. So with our Pet computer, we made a program to print a runner's pace chart.

This program is really composed of three sub-programs for the mile, cross-country and marathon race.

If you are an inexperienced programmer it is hard to work in anything but the base ten. My first challenge was to develop a formula for converting seconds to hours, minutes and seconds, which subroutine 1200 accomplished.

Secondly, it was important to format the printed data on an 8 1/2" wide paper printer. If you have a 16K TRS-80, you can use the "print using" statement. When our Commodore printer comes it will also have formatting capability. If your printer doesn't have formatting, you have to allow for greater spacing.

The program is fairly straightforward, using lap or mile multiplying values for successive laps or miles. You could also add a percentage factor for pace adjustment between the different laps.

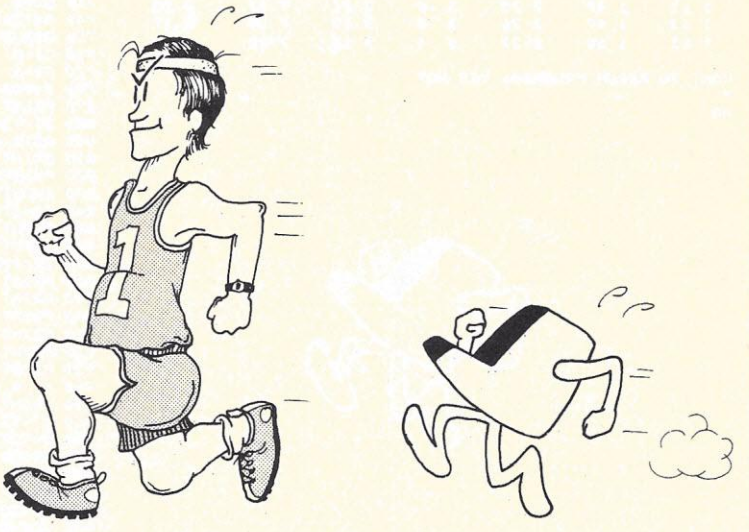
Once you enter the program, simply select the desired sub-program and enter the fastest and slowest laps or miles you want your computer to print.

Put your RACE chart on your locker door, set your goals and run your race.

P.S. — Besides your dad, your coach at school may want a chart too! □

Sample Run

```
                RACE

RUN MILE, CROSS COUNTRY, OR MARATHON, TYPE 1,2,3
?
1

ENTER FASTEST LAP TIME, SECONDS
?
60
ENTER SLOWEST LAP TIME, SECONDS
?
70


                MILE RACE

1ST LAP  2ND LAP  3RD LAP  4TH LAP  MI/ HR
MIN SEC  MIN SEC  MIN SEC  MIN SEC

  1  0     2  0     3  0     4  0    15.00
  1  1     2  2     3  3     4  4    14.75
  1  2     2  4     3  6     4  8    14.52
  1  3     2  6     3  9     4 12    14.29
  1  4     2  8     3 12     4 16    14.06
  1  5     2 10     3 15     4 20    13.85
  1  6     2 12     3 18     4 24    13.64
  1  7     2 14     3 21     4 28    13.43
  1  8     2 16     3 24     4 32    13.24
  1  9     2 18     3 27     4 36    13.04
  1 10     2 20     3 30     4 40    12.86

WANT TO RERUN PROGRAM, YES NO?
?
YES
                RACE

RUN MILE, CROSS COUNTRY, OR MARATHON, TYPE 1,2,3
?
2

ENTER FASTEST MILE TIME...MINUTES, SECONDS
?
7,0
ENTER SLOWEST MILE TIME...MINUTES, SECONDS
?
7,30


            CROSS COUNTRY RACE

1ST MILE  2ND MILE  3RD MILE  MI/HR
MIN SEC   MIN SEC   MIN SEC

  7  0    14  0    21  0     8.57
  7  1    14  2    21  3     8.55
  7  2    14  4    21  6     8.53
  7  3    14  6    21  9     8.51
  7  4    14  8    21 12     8.49
  7  5    14 10    21 15     8.47
  7  6    14 12    21 18     8.45
  7  7    14 14    21 21     8.43
  7  8    14 16    21 24     8.41
  7  9    14 18    21 27     8.39
  7 10    14 20    21 30     8.37
  7 11    14 22    21 33     8.35
  7 12    14 24    21 36     8.33
  7 13    14 26    21 39     8.31
  7 14    14 28    21 42     8.29
  7 15    14 30    21 45     8.28
  7 16    14 32    21 48     8.26
  7 17    14 34    21 51     8.24
  7 18    14 36    21 54     8.22
  7 19    14 38    21 57     8.20
  7 20    14 40    22  0     8.18
  7 21    14 42    22  3     8.16
  7 22    14 44    22  6     8.14
  7 23    14 46    22  9     8.13
  7 24    14 48    22 12     8.11
  7 25    14 50    22 15     8.09
  7 26    14 52    22 18     8.07
  7 27    14 54    22 21     8.05
  7 28    14 56    22 24     8.04
  7 29    14 58    22 27     8.02
  7 30    15  0    22 30     8.00
```

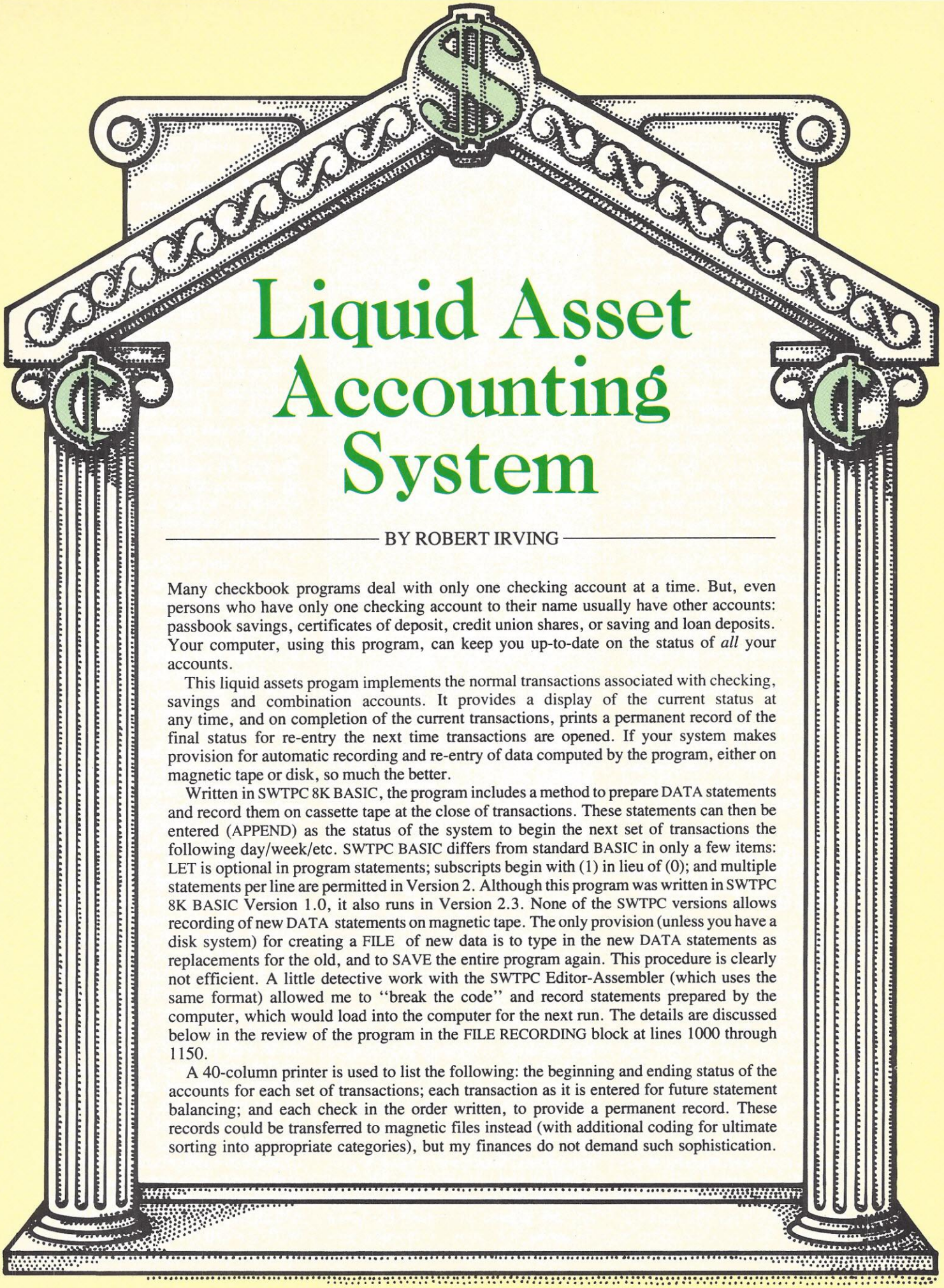


Sample Run continued

```
WANT TO RERUN PROGRAM, YES NO?
?
YES
                    RACE

RUN MILE, CROSS COUNTRY, OR MARATHON, TYPE 1,2,3
?
3

ENTER FASTEST MILE TIME...MIN,SEC
?
6,50
ENTER SLOWEST MILE TIME...MIN,SEC
?
7,20


              MARATHON RACE

10 MILE 15 MILE 20 MILE 25 MILE FINISH MIN/MILE MI/HR
HRS MIN HRS MIN HRS MIN HRS MIN HRS MIN MIN/SEC

  1  8    1 42    2 16    2 50    2 59    6 50     8.78
  1  8    1 43    2 17    2 51    3  0    6 52     8.73
  1  9    1 43    2 18    2 52    3  1    6 55     8.68
  1  9    1 44    2 18    2 53    3  2    6 57     8.64
  1  9    1 44    2 19    2 54    3  3    6 59     8.59
  1 10    1 45    2 20    2 55    3  4    7  1     8.54
  1 10    1 45    2 21    2 56    3  5    7  4     8.50
  1 11    1 46    2 22    2 57    3  6    7  6     8.45
  1 11    1 47    2 22    2 58    3  7    7  8     8.41
  1 11    1 47    2 23    2 59    3  8    7 11     8.36
  1 12    1 48    2 24    3  0    3  9    7 13     8.32
  1 12    1 48    2 25    3  1    3 10    7 15     8.27
  1 12    1 49    2 25    3  2    3 11    7 17     8.23
  1 13    1 49    2 26    3  3    3 12    7 20     8.19
  1 13    1 50    2 27    3  4    3 13    7 22     8.14

WANT TO RERUN PROGRAM, YES NO?
?
NO
```

Program Listing

```
 50 PRINT'                    RACE'
 60 PRINT
 70 PRINT'RUN MILE, CROSS COUNTRY, OR MARATHON, TYPE 1,2,3'
 80 INPUT Z
 90 IF Z=1 THEN 120
100 IF Z=2 THEN 500
110 IF Z=3 THEN 810
120 PRINT
130 PRINT'ENTER FASTEST LAP TIME, SECONDS'
140 INPUT T
150 T=T-1
160 PRINT'ENTER SLOWEST LAP TIME, SECONDS'
170 INPUT T1
180 PRINT
190 PRINT
200 PRINT'                   MILE RACE'
210 PRINT
220 PRINT'1ST LAP  2ND LAP  3RD LAP  4TH LAP  MI/ HR'
230 PRINT'MIN SEC  MIN SEC  MIN SEC  MIN SEC '
240 : ##-##    ##-##    ##-##    ##-##    ##.##
250 PRINT
260 T=T+1
270 S=T
280 GO SUB 1200
290 A1=M
300 A2=S
310 S=T*2
320 GOSUB 1200
330 B1=M
340 B2=S
350 S=T*3
360 GOSUB 1200
370 C1=M
380 C2=S
390 S=T*4
400 GOSUB 1200
410 D1 =M
420 D2=S
430 E=900/T
440 PRINT USING 240,A1,A2,B1,B2,C1,C2,D1,D2,E
450 IF T= T1 GOTO 1240
460 GOTO 260
500 PRINT
510 PRINT'ENTER FASTEST MILE TIME...MINUTES, SECONDS'
520 INPUT T,T1
530 T2=(T*60)+(T1-1)
540 PRINT'ENTER SLOWEST MILE TIME...MINUTES, SECONDS'
550 INPUT T3,T4
560 T5=(T3*60)+T4
570 PRINT
580 PRINT
590 PRINT'                CROSS COUNTRY RACE'
600 PRINT
610 PRINT'1ST MILE  2ND MILE  3RD MILE  MI/HR'
620 PRINT'MIN SEC   MIN SEC   MIN SEC   '
630 : ## ##    ## ##    ## ##    ##.##
640 PRINT
650 T2=T2+1
660 S=T2
670 GOSUB 1200
680 A1=M
690 A2=S
700 S=T2*2
710 GOSUB 1200
720 B1=M
730 B2=S
740 S=T2*3
750 GOSUB 1200
760 C1=M
770 C2=S
780 E=900/T2
790 PRINT USING 630,A1,A2,B1,B2,C1,C2,E*4
800 IF T2=T5 GOTO 1240
805 GOTO 650
810 PRINT
820 PRINT'ENTER FASTEST MILE TIME...MIN,SEC'
830 INPUT T,T1
840 T2=(T*60)+(T1-2.2884386)
850 PRINT'ENTER SLOWEST MILE TIME...MIN,SEC'
860 INPUT T3,T4
870 T5=(T3*60)+T4
880 PRINT
890 PRINT
900 PRINT'              MARATHON RACE'
910 PRINT
920 PRINT'10 MILE 15 MILE 20 MILE 25 MILE FINISH MIN/MILE MI/HR'
930 PRINT'HRS MIN HRS MIN HRS MIN HRS MIN HRS MIN MIN/SEC'
940 :  # ##    # ##    # ##    # ##    # ##    # ##    ##.##
950 PRINT
960 T2=T2+2.2884386
970 S=T2*10
980 GOSUB 1200
990 A1=H
1000 A2=M
1010 S=T2*15
1020 GOSUB 1200
1030 B1=H
1040 B2=M
1050 S=T2*20
1060 GOSUB 1200
1070 C1=H
1080 C2=M
1090 S=T2*25
1100 GOSUB 1200
1110 D1=H
1120 D2=M
1130 S=T2*26.21875
1140 GOSUB 1200
1150 E1=H
1160 E2=M
1162 S=T2
1164 GOSUB 1200
1166 F1=M
1168 F2=S
1170 E=900/T2
1180 PRINT USING 940,A1,A2,B1,B2,C1,C2,D1,D2,E1,E2,F1,F2,E*4
1190 IF T2>= T5 GOTO 1240
1195 GOTO 960
1200 H=INT(S/3600)
1210 M=INT((S-H*3600)/60)
1220 S=S-H*3600-(INT((S-H*3600)/60))*60
1230 RETURN
1240 PRINT
1250 PRINT'WANT TO RERUN PROGRAM, YES NO?'
1260 INPUT A$
1270 IF A$= 'YES' GOTO 50
1300 END
```



Liquid Asset Accounting System

BY ROBERT IRVING

Many checkbook programs deal with only one checking account at a time. But, even persons who have only one checking account to their name usually have other accounts: passbook savings, certificates of deposit, credit union shares, or saving and loan deposits. Your computer, using this program, can keep you up-to-date on the status of *all* your accounts.

This liquid assets progam implements the normal transactions associated with checking, savings and combination accounts. It provides a display of the current status at any time, and on completion of the current transactions, prints a permanent record of the final status for re-entry the next time transactions are opened. If your system makes provision for automatic recording and re-entry of data computed by the program, either on magnetic tape or disk, so much the better.

Written in SWTPC 8K BASIC, the program includes a method to prepare DATA statements and record them on cassette tape at the close of transactions. These statements can then be entered (APPEND) as the status of the system to begin the next set of transactions the following day/week/etc. SWTPC BASIC differs from standard BASIC in only a few items: LET is optional in program statements; subscripts begin with (1) in lieu of (0); and multiple statements per line are permitted in Version 2. Although this program was written in SWTPC 8K BASIC Version 1.0, it also runs in Version 2.3. None of the SWTPC versions allows recording of new DATA statements on magnetic tape. The only provision (unless you have a disk system) for creating a FILE of new data is to type in the new DATA statements as replacements for the old, and to SAVE the entire program again. This procedure is clearly not efficient. A little detective work with the SWTPC Editor-Assembler (which uses the same format) allowed me to "break the code" and record statements prepared by the computer, which would load into the computer for the next run. The details are discussed below in the review of the program in the FILE RECORDING block at lines 1000 through 1150.

A 40-column printer is used to list the following: the beginning and ending status of the accounts for each set of transactions; each transaction as it is entered for future statement balancing; and each check in the order written, to provide a permanent record. These records could be transferred to magnetic files instead (with additional coding for ultimate sorting into appropriate categories), but my finances do not demand such sophistication.

Illustration by Josh Randall

This program allows me to keep track of my liquid assets and to keep the maximum amount of such assets in interest-bearing accounts until needed to defray obligations. I perform subsequent actions, such as statement verification and income tax preparation, by hand, aided by the compact records the bank balance program prepares.

For each set of transactions, the program provides a printout of the opening balances, each transaction, and the closing balances. The system is completely subject to manual verification and auditing. The opening balances on the current set of transactions should match the closing balances on the prior printout; the opening balances on the subsequent printout should match the balances at the last closing. If they don't, the computer made a read or write error. When you've verified all of the transactions against your bank statements and checked the corresponding balances for a given printout, you can cut off and throw away the opening balance and transaction portion of the printout. Thus you can keep the check record and closing balances as the permanent record in half the volume. My final record, compiled weekly on adding machine tape, is usually three to five inches long, fitting easily into a small envelope. For an example of a typical printout, see Figure 1. (The bank names used in the example are real; the balances are fictitious.)

After loading the program, you need to APPEND the DATA statements written on magnetic tape (or disk) the last time you used the program. Typical DATA statements look like this:

```
0039 REM ** DATE: 02-11-79
0040 DATA 87.9 ,1084.7 ,159.83 ,0
0050 DATA 204.72 ,327.3 ,0 ,1234.56
0060 DATA 27.5 ,192.75 ,0 ,654.32
0070 DATA 437
```

Statement 39, included to identify the record, is the date of the last set of transactions. Statements 40, 50 and 60 give the checking and savings balances for six banks in order. Note that some banks have both a checking and a savings account; others have only one. The final statement, 70, is a system serial for the next check to be written; it is incremented each time a check is written. This number could be the serial for a check from a given bank; but since many checks come with preprinted serials, I include the bank serial in the check record, and use the system serial for continuity purposes only. Note that each number in the DATA statements is written with a space between the number and the separating comma. This space results from writing the record using the PRINT statement, which includes the space. Since BASIC will not read an appended space as part of a numeric value, we must read the data as string variables and extract the value with the VAL statement.

```
OPEN FILE ON:   02-15-79
        CURRENT BALANCES
  BANK        CHECK     SAVING

CITIZEN      44.2       97.63
1ST NAT'L    467        0
1ST STATE    0.46       1234.56
HOME SAVE    0          65.72
INDEPEND     0.46       9.23
NORTH SAV    0          456.78

TOTALS:      512.12     1766.29
GRAND TOTAL:    2278.41

TRANSFER FROM INDEPEND SAVING TO
CHECK - $5
42 ,FN422,QUICK MRT,FOOD,47.22
DEPOSIT IN NORTH SAV SAVING - $500
WITHDRAW FROM NORTH SAV SAVING - $50


42 FN422,QUICK MRT,FOOD,$47.22
43 ,,,$0


CLOSE FILE ON:  02-15-79
        CURRENT BALANCES
  BANK        CHECK     SAVING

CITIZEN      44.2       97.63
1ST NAT'L    419.78     0
1ST STATE    0.46       1234.56
HOME SAVE    0          65.72
INDEPEND     5.46       4.23
NORTH SAV    0          906.78

TOTALS:      469.9      2211.29
GRAND TOTAL:    2681.19
```

Figure 1

```
OPEN FILE ON:   02-15-79
        CURRENT BALANCES
  BANK        CHECK     SAVING

CITIZEN      44.2       97.63
1ST NAT'L    467        0
1ST STATE    0.46       1234.56
HOME SAVE    0          65.72
INDEPEND     0.46       9.23
NORTH SAV    0          456.78

TOTALS:      512.12     1766.29
GRAND TOTAL:    2278.41
```

Figure 2

Referring to the program listing, statement 10 provides for six banks, two accounts (checking and savings) per bank (some of which may be nulls), six bank names, two types of accounts, and the writing of as many as 40 checks per set of transaction. You can change these numbers to fit your personal requirements. Statements 20 and 30 provide bank and account names. The quotation marks on the last entry in each line are needed to include the space following the name, a function provided by the position of the comma in the data entries. Statements 80 through 190 read in the data for the program. Note the string READs in statements 140 and 180; the space is still there in statement 70, even if not visible. Statement 200 sets an index for manipulating the checks written in this set of transactions. Statement 210 requires input of current date in month, day, year format. Be sure the printer is turned on before you press RETURN on this input, or the opening balances will not be printed. If the printer is not on, the DATA statements will produce the OPEN FILE printout shown in Figure 1. Inputting "7" (BLNC) at either SELECT BANK or SELECT ACTION will put Figure 2 on the CRT display.

Note that the SAVINGS total does *not* include the CITIZEN SAVINGS balance because the Citizen account is a combined account in which checks can be written against the savings balance. The CHECK balance is the net remaining after checks have been written; the SAVINGS balance is maintained for purposes of interest only, and is not part of the liquid assets.

A(1,2) and A(2,2) are omitted from statement 430 — A(1,2) (the Citizen account) for the reason cited above, and A(2,2) because there is no such account. (Barring error, the non-existent A(2,2) account would have been taken care of by the zero balance under SAVINGS on the second row; but why lengthen the program and invite trouble unnecessarily?)

After printing the balances, either on paper or on the CRT (the latter starting at statement 310, which homes the cursor), the program jumps to statement 2000, the SELECT BANK function, with provision for closing or showing current balances. If a bank is selected, statements 2040 and 2050 require selection of CHECK or SAVING . Selection of an invalid number or of a non-existent account will require re-entry. Selection of CITIZEN SAVINGS elicits only a caution (CHECKING IS ACTIVE ACCOUNT), since withdrawals and deposits can be made to the SAVINGS account, but most transactions are made with the CHECK account. Successful entry jumps the program to statements 480 and 490, requiring selection of an action. The choices are DEPOSit, WITHdraw, write CHECK, TRANSfer savings to checking, CHaNGe to another bank, CLOSE transactions and obtain current BaLaNCes. If the printer is left on, the transactions will all be printed. Selection of DEPOS, WITH or CHECK will prompt for the necessary entries, print the details and

return to the same account. TRANS must start with a SAVINGS account (error otherwise), prompt for entry, print details and end in CHECK account, showing balances for both accounts.

Selection of other than the SAVINGS account in one of the two banks with both CHECK and SAVINGS accounts will require a new selection. CHNG jumps the program to statement 2000 for a new selection of bank. CLOSE jumps to 800, which prints out the sequence of checks written in this set of transactions, and stops after prompting for a tape loading. The BANK STATUS tape will still be in the cassette recorder, since the last action using the tape was to APPEND the DATA statements from the last set of transactions. Type CONT on the keyboard and turn on the record switch; after about 5 seconds, press RETURN. The REM ** DATE: line will be transferred to the tape with the current date (entered at the beginning of the program) appended, preceded by an ASCII 02, and followed by an ASCII 04. These codes identify the information as a valid statement to the SWTPC BASIC on read-in.

Next, the program jumps to a subroutine, statements 3000 through 3030, which introduces a delay by printing ASCII 127 fifteen times. This delay is absolutely essential to re-entry of the information into the program later. On loading into SWTPC BASIC, each statement is intially stored in temporary buffer and is then transferred to permanent storage. The delay provides times for this transfer; if the delay is omitted, the statement will not be loaded. In a similar fashion, each of the DATA statements is transferred to tape. The block of data is concluded with ASCII 03 to signify the end of the message, and ASCII 20 to turn off the recorder. The line length is set to 100 at statement 1000 to inhibit the automatic carriage return and line feed during the DATA print; otherwise, the CR/LF would eliminate part of the DATA statement.

At any point in the process, you can request BLNC and obtain a full display of the bank balances current to that point. Further, following each transaction, the current balance is printed on the display, allowing corrections. For example, a check written for more than the balance (overdraft) results in a negative balance which could be corrected by a transfer from savings.

A few cautions are in order: The interest must be added by DEPOS to each savings account when posted in your passbook or statement. The TRANS function is written to facilitate the "telephone transfer" type of account, where a single action on your part will move funds from savings to checking account. If you have a conventional savings account, two actions will be required: a withdrawal slip for the savings account and a deposit slip for the checking account. If you have a "telephone transfer" account with a *savings-only* bank (row 2) and always transfer to the *same* checking account in another bank (row 3), then statements 690 through 780 could be rewritten as follows:

```
0690 IF Q1<>2 THEN 2000
0700 IF Q2<>2 THEN 785
0710 LINE=40
0720 PRINT "RECEIVER IS"
  :A$(3);B$(1)
0730 INPUT "AMOUNT
  TRANSFERRED = $".T
0735 PRINT #7, "TRANSFER
  FROM";A(2);B$(2);"TO";
  A$(3);B$(1);"-$";T
0740 A(2,2)=A(2,2)-T
0745 PRINT "TRANSMIT
  BALANCE = $";A(2,2)
0750 A(3,1)=A(3,1)+T
0755 PRINT "RECEIVE BALANCE
  = $";A(3,1)
0760 Q2=1
0770 PRINT "CHANGED TO
  CHECKING ACCOUNT"
0780 GOTO 480
```

You can enter error corrections two ways: (1) Rewrite the DATA statements to show the correct balances at the opening of the transactions. (2) Enter the correction as a DEPOS or WITH transaction. The first method leaves no "tracks" for auditing, hence should be discouraged. The second method allows for audit, and the transaction can be annotated by hand to identify the source of the DEPOS or WITH. □

Program Listing

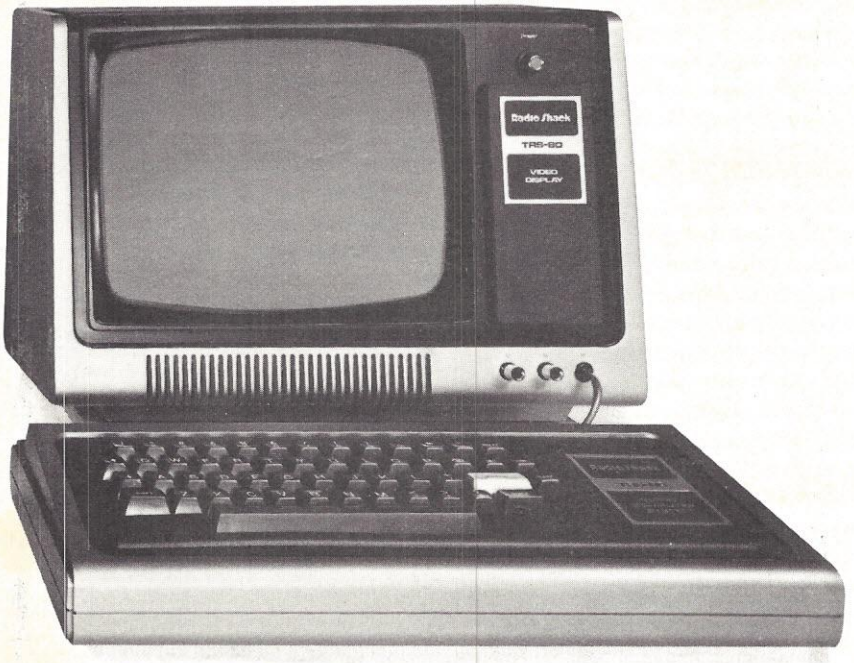
```
0009 REM ** BANK BALANCE PROGRAM.
0010 DIM A(6,2),A$(6),B$(2),C$(40),D$(40
),E$(40),E(40)
0020 DATA CITIZEN ,1ST NAT'L ,1ST STATE
,HOME SAVE ,"INDEPEND "
0030 DATA NORTH SAV ,CHECK ,"SAVING "
0080 FOR I=1 TO 6
0090 READ A$(I)
0100 NEXT I
0110 READ B$(1),B$(2)
0120 FOR I=1 TO 6
0130 FOR J=1 TO 2
0140 READ F$
0150  A(I,J)=VAL(F$)
0160 NEXT J
0170 NEXT I
0180 READ N$
0190  N=VAL(N$)
0200  M=1
0210 INPUT "DATE:  MM-DD-YY",U$
0220 PORT= 7
0230 PRINT "OPEN FILE ON:  ",U$
0240 GOTO 320
0250 PORT= 7
0260 PRINT "CLOSE FILE ON:  ",U$
0270 GOTO 320
0310 PRINT CHR$(16);CHR$(22);
0320 PRINT TAB(10);"CURRENT BALANCES"
0330 PRINT TAB(3);"BANK";TAB(13);B$(1);T
AB(22);B$(2)
0335  P2=15:P3=26
0340 PRINT
0350 FOR I=1 TO 6
0360 PRINT A$(I);
0370 PRINT TAB(P2-LEN(STR$(INT(A(I,1))))
);A(I,1);
0380 PRINT TAB(P3-LEN(STR$(INT(A(I,2))))
);A(I,2)
0390 NEXT I
0420  T1=A(1,1)+A(2,1)+A(3,1)+A(5,1)
0430  T2=A(3,2)+A(4,2)+A(5,2)+A(6,2)
0440 PRINT
0450 PRINT "TOTALS:";TAB(P2-LEN(STR$(INT
(T1))));T1;
0455 PRINT TAB(P3-LEN(STR$(INT(T2))));T2
```

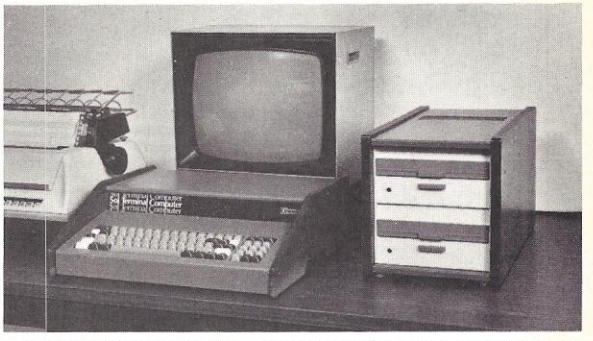
Program Listing continued

```
0460 PRINT "GRAND TOTAL:";TAB(16);T1+T2
0465 PRINT
0470 PORT= 1
0475 GOTO 2000
0479 REM ** SELECT ACTION
0480 PRINT "DEPOS 1  WITH 2  CHECK 3"
0490 INPUT "TRANS 4  CHNG 5  CLOSE 6  BL
NC ?",U
0500 ON U GOTO 510,560,610,690,2000,800,
310
0510 INPUT "DEPOSIT = $",D
0520 PRINT #7,"DEPOSIT IN ";A$(Q1);B$(Q2
);"- $";D
0530  A(Q1,Q2)=A(Q1,Q2)+D
0540 GOSUB 1500
0550 GOTO 480
0560 INPUT "WITHDRAW = $",W
0570 PRINT #7,"WITHDRAW FROM ";A$(Q1);B$
(Q2);"- $";W
0580  A(Q1,Q2)=A(Q1,Q2)-W
0590 GOSUB 1500
0600 GOTO 480
0609 REM ** CHECK WRITE
0610 IF Q2<>1 THEN 670
0615 LINE= 100
0620 INPUT "CHECK #/PAYEE/PURPOSE/AMOUNT
",C$(M),D$(M),E$(M),E(M)
0625 PRINT #7,N;",";C$(M);",";D$(M);",";
E$(M);",";E(M)
0630  A(Q1,1)=A(Q1,1)-E(M)
0635  N=N+1
0640  M=M+1
0650 GOSUB 1500
0660 GOTO 480
0670 PRINT "MUST BE CHECKING ACCOUNT"
0680 GOTO 2000
0689 REM ** SAVINGS TRANSFER
0690 IF Q1=3 THEN 705
0695 IF Q1=5 THEN 705
0700 GOTO 2000
0705 IF Q2<>2 THEN 785
0710 LINE= 40
0720 PRINT "RECEIVER IS ";A$(Q1);B$(1)
0730 INPUT "AMOUNT TRANSFERRED = $",T
0735 PRINT #7, "TRANSFER FROM ";A$(Q1);B
$(2);"TO ";B$(1);"- $";T
0740  A(Q1,2)=A(Q1,2)-T
0745 PRINT "TRANSMIT BALANCE = $";A(Q1,2
)
0750  A(Q1,1)=A(Q1,1)+T
0755 PRINT "RECEIVE BALANCE = $";A(Q1,1)
0760  Q2=1
0770 PRINT "CHANGED TO CHECKING ACCOUNT"
0780 GOTO 480
0785 PRINT "MUST BE SAVINGS ACCOUNT"
0790 GOTO 2000
0799 REM ** CLOSING
0800 PORT= 7
0805 PRINT
0810 PRINT
0815 LINE= 100
0820 FOR I=1 TO M
0830 PRINT N-M+I;C$(I);",";D$(I);",";E$(
I);",$";E(I)
0840 NEXT I
0850 PRINT
```

```
0860 PRINT
0870 PORT= 1
0880 PRINT CHR$(16);CHR$(22);
0890 PRINT "PREPARE TAPE FOR RECORDING"
0900 STOP
0910 GOTO 1000
0999 REM ** FILE RECORDING
1000 LINE= 100
1010 PRINT CHR$(02);"0039 REM ** DATE:
   ";U$;CHR$(04)
1020 GOSUB 3000
1030 PRINT CHR$(02);"0040 DATA ";A(1,1);
",";A(1,2);",";
1040 PRINT A(2,1);",";A(2,2);CHR$(04)
1050 GOSUB 3000
1060 PRINT CHR$(02);"0050 DATA ";A(3,1);
",";A(3,2);",";
1070 PRINT A(4,1);",";A(4,2);CHR$(04)
1080 GOSUB 3000
1090 PRINT CHR$(02);"0060 DATA ";A(5,1);
",";A(5,2);",";
1100 PRINT A(6,1);",";A(6,2);CHR$(04)
1110 GOSUB 3000
1120 PRINT CHR$(02);"0070 DATA ";N;CHR$(
04)
1130 GOSUB 3000
1140 PRINT CHR$(03);CHR$(19);CHR$(20)
1150 GOTO 250
1499 REM ** PRINT BALANCE
1500 PRINT CHR$(16);CHR$(22);
1510 PRINT "BALANCE ";A$(Q1);B$(Q2);"= $
";A(Q1,Q2)
1520 RETURN
1999 REM ** SELECT BANK
2000 PRINT "  CB 1  FN 2    FS 3  CLOSE
8"
2010 INPUT "  HS 4  IB 5    NS 6   BLNC
7",Q1
2015 IF Q1<1 THEN 2000
2020 IF Q1>8 THEN 2000
2025 IF Q1=7 THEN 310
2030 IF Q1=8 THEN 800
2040 PRINT B$(1);"1     ";B$(2);"2";
2050 INPUT Q2
2060 IF Q2<1 THEN 2040
2070 IF Q2>2 THEN 2040
2080  Q=Q1*10+Q2
2090 IF Q=12 THEN 2140
2100 IF Q=22 THEN 2160
2110 IF Q=41 THEN 2160
2120 IF Q=61 THEN 2160
2130 GOTO 2180
2140 PRINT "CHECKING IS ACTIVE ACCOUNT"
2150 GOTO 2190
2160 PRINT "THERE IS NO SUCH ACCOUNT"
2170 GOTO 2040
2180 GOSUB 1500
2190 GOTO 400
2999 REM ** DELAY
3000 FOR I=1 TO 15
3010 PRINT CHR$(127);
3020 NEXT I
3030 RETURN
9999 END
```

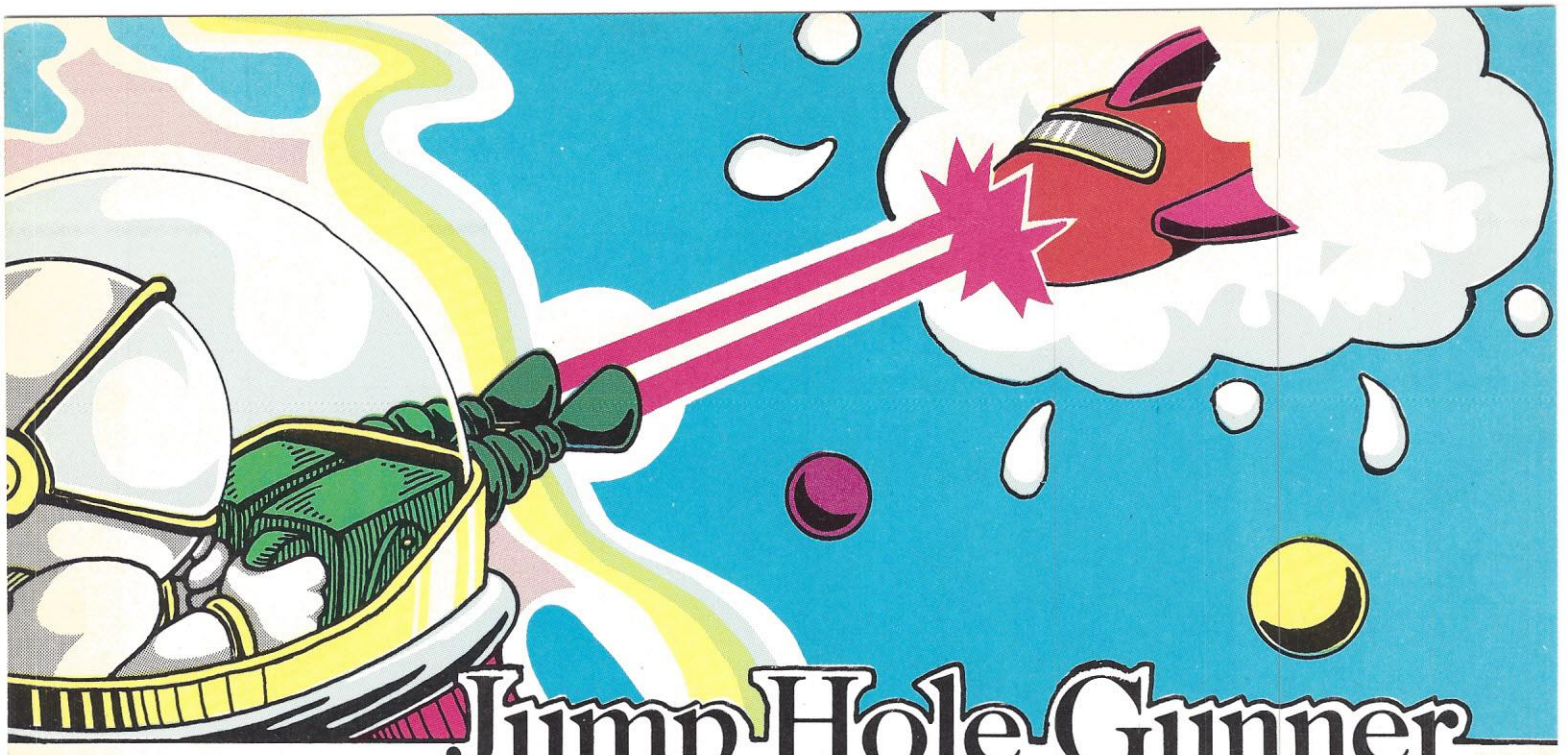
TRS-80*, Sol*, Sorcerer*





byte storage capacity can be operated with general ledger, accounts receivable, and payable. **CIRCLE 18**

*TRS-80 is a TM of Tandy Corp.
SOL and Helios are TM's of Processor Technology Corp.
Sorcerer is a TM of Exidy Inc. CP/M is a TM of Digital Research.



Jump Hole Gunner

BY JOHN WALKER

Combat Briefing. The late incompetents of Hyperspace Jump Base Gimel III have lost their Jump Hole to the Hacquerite invaders who are now using Gimel III as a base from which they attack every other Jump Base in the Galaxy. You have been hired by the Galactic Federation to protect Jump Base Aleph Null from this latest menace. For trans-Galactic commerce to continue, Aleph Null's jump hole must remain open at periodic intervals to allow the exit and entry of Federation supply ships. As a jump base gunner, you have sufficient phaser power for six firings into the jump hole. Your mission is not complete until all six shots have been expended.

You will begin your first mission as a Third-class Gunner with the Federation's standard enlistment bonus of ten (10) Galactics. Should you survive and successfully complete the mission, you will be promoted to Second-Class and paid the promotion bonus of ten (10) Galactics. If you survive the Second-Class mission you will again be promoted and paid the standard bonus. In addition to your promotion bonuses you will be credited (or debitted, as the case may be) commensurate with your skill as a gunner in combat.

At the completion of your First-Class mission you may elect to retire with your winnings (of course, if your score is a negative value you will owe this amount to the Federation), or you may choose to continue as a First-Class Gunner either to increase your profits further or to get out of debt to the Federation. Your first priority is to survive the Hacquerite attacks. Your second priority is to gain promotion. Your third priority is to exercise your marksmanship in such a way as to maximize your profits and cut your losses.

As your rank increases so do the number and difficulty of the types of targets you must face (see Target Table.) As a First-Class Gunner, for example, you will have to distinguish instantly among six types of targets, including the dreaded Hacquerite shapeshifters. The only effective defense against the shapeshifters is an instantaneous ability to glimpse the future.

In short, this duty, though potentially lucrative, requires extraordinary powers of concentration, coordination, discrimination and even precognition. Remember, the interconnected fates of you, your base and its crew — and perhaps of the Federation itself are at the tip of your finger. Good hunting. May your fire be unerring and your retirement First-Class.

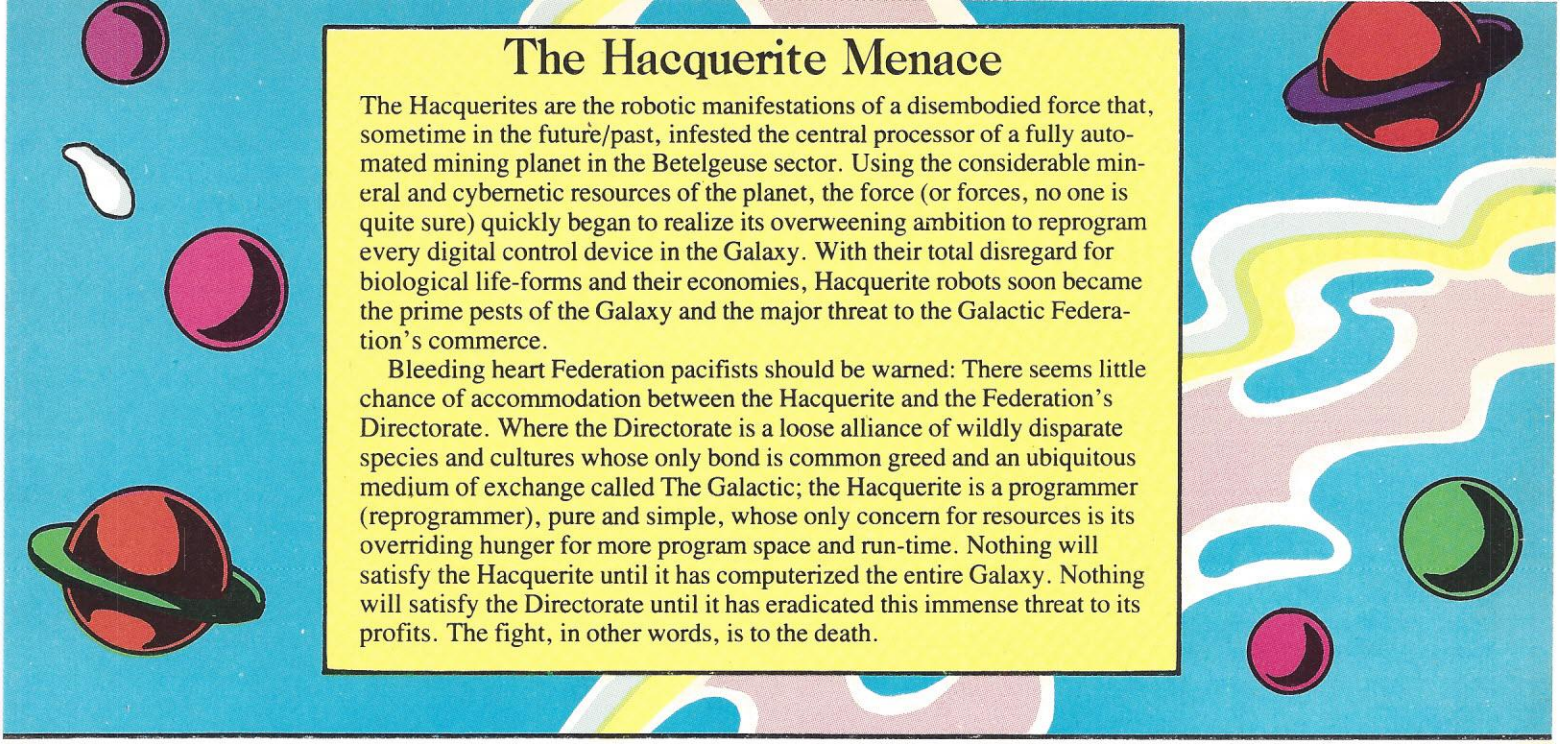
Playing the Game. This program was written for Texas Instruments' TI-58 or TI-59 handheld programmable calculators. It may, however, be adapted to any other machine with sufficient memory and indirect addressing capabilities. Since handheld calculators do not yet allow alphanumeric displays, you must pay attention to the format and sequence of the displays to avoid confusing the different types of game data. The program includes audio as well as visual formats. These sound effects may be implemented by placing an AM transistor radio near the calculator and tuning it to the "white noise" (static) between stations.

The game is played as a sequence of three or more missions of six shots each. The object is to complete all three missions and retire as a First-Class Gunner with as much profit as possible. Almost all mistakes are fatal and are signaled by a string of flashing nines. The string length indicates the extent of damage to the base. Gunners who wipe-out are ignominiously demoted and must begin the game again as Third-Class Gunners. All profits and losses accrued to that point are defaulted.

Flying the Simulator. As the game challenges reflexes and hand/eye coordination, beginning gunners are strongly urged to first fly the Firing Simulator as Cadets before attempting to enter combat as Third-Class Gunners. The Firing Simulator lets you fly single, six-shot missions against one target type. (See Target 1 on the Target Table.)

To initiate the firing simulator, press CLR D. The display will flash the initial score ("0.06") three times ("beep beep beep" on the audio indicator). The

Illustration by Josh Randall



The Hacquerite Menace

The Hacquerites are the robotic manifestations of a disembodied force that, sometime in the future/past, infested the central processor of a fully automated mining planet in the Betelgeuse sector. Using the considerable mineral and cybernetic resources of the planet, the force (or forces, no one is quite sure) quickly began to realize its overweening ambition to reprogram every digital control device in the Galaxy. With their total disregard for biological life-forms and their economies, Hacquerite robots soon became the prime pests of the Galaxy and the major threat to the Galactic Federation's commerce.

Bleeding heart Federation pacifists should be warned: There seems little chance of accommodation between the Hacquerite and the Federation's Directorate. Where the Directorate is a loose alliance of wildly disparate species and cultures whose only bond is common greed and an ubiquitous medium of exchange called The Galactic; the Hacquerite is a programmer (reprogrammer), pure and simple, whose only concern for resources is its overriding hunger for more program space and run-time. Nothing will satisfy the Hacquerite until it has computerized the entire Galaxy. Nothing will satisfy the Directorate until it has eradicated this immense threat to its profits. The fight, in other words, is to the death.

score is given here and in the full-scale game in the format "X.YY", where X is the cumulative score in Federation Galactics and .Y is the number of shots remaining in the mission. This score flashes after each shot and warns of the next target.

The target appears after a random interval of between four and nine seconds. The Simulator's target is a momentarily flashed "-1". As soon as the target leaves the screen the Cadet must gently but quickly press R/S to fire. If the Cadet is too slow, which is often the case, he or she will miss the target and the inexorable string of nines will flash. If the Cadet hits the target a string of ones will immediately appear on the screen. The Cadet's object is to fire quickly enough to minimize the length of this string, thus maximizing the score. *(Note:* The Firing Simulator's and the Third-Class Gunner's scores are always a negative value.) Press A to record the score.

In addition to firing too slowly, you may also undershoot the target by firing too quickly. If, upon firing, the Cadet freezes a "1" or a "-1" on the screen, nines will flash when the Cadet records the score. Any time a Cadet wipes out he or she must begin again by pressing CLR D. At the end of a successfully completed mission the Cadet's total score will flash continuously on the screen. Several successful Simulator missions should qualify the Cadet to enter combat as a Third Class Gunner.

All-Out Combat. Begin the full-scale game by pressing E. The screen will display the Third-Class Gunner's rating ("3. ee00"). The gunner's new rank is displayed at the end of each successfully completed mission. The enlistment or promotion bonus is automatically added to the score displayed at the beginning of the next mission. (The accumulated score in Federation Galactics may also be accessed by pressing RCL 02.) Press R/S to begin. The display flashes the initial score ("10.06"), indicating the enlistment bonus of 10 Galactics and the gunner's initial six shots. This score is followed, after a random interval, by a target. The gunner must quickly choose the proper course of action and execute it before the target executes the gunner. If the gunner chooses the wrong course of action or an ill-timed correct action, he or she will wipe out and must begin again by pressing CLR E.

The proper course of action depends on the nature of the particular target. The Hacquerites have an arsenal of several weapons which they may send into Aleph Null's open jump hole from the captured base at Gimel III. The unwary gunner may be blasted out of space by a Hacquerite firing pod, rammed by a robot warship or blown to bits by a torpedo. Incompetents may also destroy themselves by firing into antigrav mines, or they can incur Federation penalties by firing on their own supply vessels. And then, against the First-Class Gunner, there is the ultimate Haquerite weapon: the dreaded Shape-shifter, which may either blow up if it's hit or blow up the gunner if it's not. Only precognition is an adequate defense against these horrible devices.

The Target Table explains the nature of the targets in detail along with their effects and the appropriate procedures to combat them. The First-Class Gunner must be prepared to confront targets one and two. (Note: Third-Class Gunners can only cut their losses. A perfect Third-Class mission will deduct six Galactics from the enlistment bonus.) Mines, unless fired upon, do not affect the score. Torpedoes do not affect the score unless they are not fired upon. Ramming ships increment the gunner's score proportionate to the length of time the gunner waits to fire. Of course, the gunner who waits too long to shoot will ultimately be rammed and wiped out. Supply ships that are not fired upon will increment both the gunner's score and the number of shots left in the mission. First-Class Gunners anxious to retire have been known to cold-bloodedly fire upon their own supply ships to avoid getting extra shots. Needless to say, this practice is highly frowned upon by the Federation.

Should the gunner complete the First-Class mission successfully, he or she may, by pressing C, elect to continue as a First-Class Gunner to increase profits or to get out of debt. Each additional mission entitles the gunner

to the standard re-enlistment bonus of ten (10) Galactics along with the unflagging gratitude to the Federation. Gunners who wipe out in a re-enlistment mission will, of course, lose all the points they have accumulated. (*Note:* Gunners who press C before completing a First-Class mission lose all accumulated profits and are automatically demoted to Third-Class.)

Simplified Game. The game may be played one mission at a time at any level of difficulty you choose. Enter the number of target types (1 to 6) you wish to combat and press D. The score is cumulative for the mission only and does not carry from one mission to the next. The mission score flashes continuously after the sixth shot. The gunner who wipes out in the simplified game must re-enter the number of target types and press CLR D to begin a new mission.

Competitive Game. By using the above simplified game option, two or more players may compete for the best mission score. The rules of competition may be left to the discretion and imagination of the participants; but it's suggested that the competing gunners agree at the start on the level of difficulty they wish to play at and on the number of missions each must fly to constitute a game. The players then alternate missions, keeping track of the best mission scores. Should a player wipe out at any point in the game, his best mission score is returned to zero. The player with the highest mission score after the agreed upon number of missions is the winner.

On Being Part of the Hacquerite Menace. Inveterate programmers may wish to defect to the Hacquerite cause to design a new weapon for the robots' arsenal. Since the game requires 312 program steps and 10 memory registers, sufficient space is left for a new weapon even on the smaller TI-58 machine. The new weapon may be implemented in the target selector terminal by inserting a subroutine call at locations 005 and 006. The defecting designer will need to understand the housekeeping and service routines labeled "CE", "A" and "RCL".

The effects of this weapon can be as terrible as the ingenuity and imaginaton of the programmer allow. It's suggested, however, that the run time of the new target be comparable to those of the other six, and that its display format be as unambiguous as possible with regard to the other targets.

The Program. Before loading the program press 1 *OP 17 to allocate 10 memory registers and 400 program locations. Absolute addresses are used to shorten run time in subroutines located at 007 and 013. The flashing nines which signal a wipe out are elicited by forcing the error condition CLR *LOG. For these instructions to have the desired effect, either error flag 8 must be preset or the instructions must be followed in the program by R/S. The wipe-out display is double locked in several locations with two R/S instructions (e.g. location 186) to prevent players from fortuitously bouncing out of a wipe-out at the first flash of nines.

The timer for the random interval before the target appears is a simple loop at location 007. The interval during which a target may be hit in the jump hole is set by having the calculator execute a string of ones beginning at location 169. The same technique is used for supply ships at location 262. (This ingenious method for timing very short intervals on a calculator comes from an article by James C. Pittman Jr., "Measuring Reaction Time with Your Programmable Calculator", in the March 1978 issue of *Personal Computing.)* The "hit strings" thus created are converted to score values in subroutine A using the calculator's base 10 logarithm function.

Locations 000 through 006 form a randomly controlled target selector terminal, and memory register 08 stores the indirect address to this terminal.

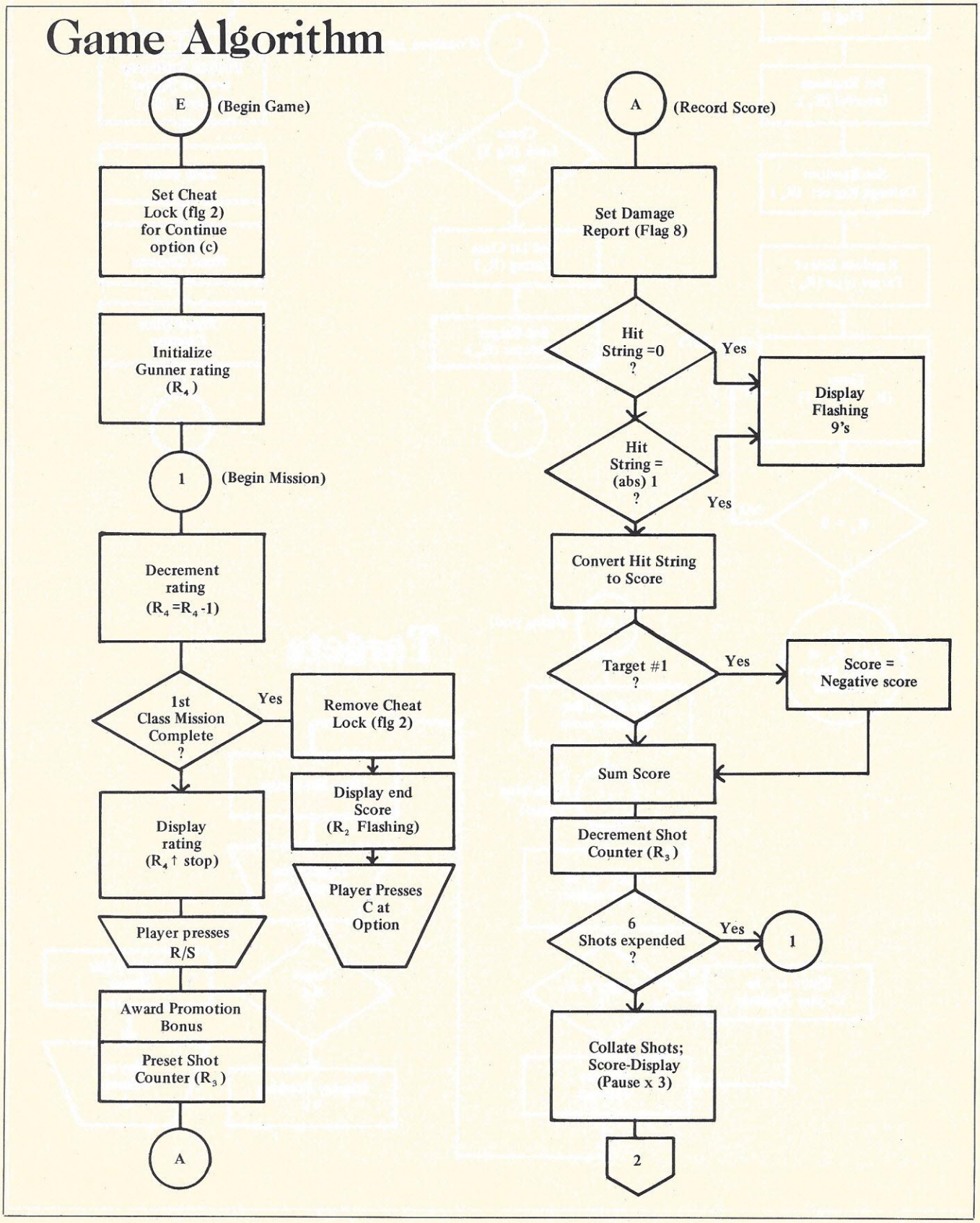
Target Table

Target No.	Display	Target Type	Explanation	Appropriate Action
1	-1.	Firing pod	Enters jump hole with phasers firing. Gunner must fire quickly to avoid extensive damage to shields or total destruction.	Fire (press R/S) as soon as target leaves screen. Press A to record score.
2	0.	Mine	Firing at mine will result in total wipe-out. Mines not fired upon have no effect upon score or shots.	No action. Prepare for next target.
3	1.	Ramming Ship	Robot ship enters jump hole on direct ram course with Aleph Null. Firing too early or too late results in wipe-out by ramming or boarding. Properly delayed shots will maximize profits.	Delay firing. Press A to record score.
4	2.	Torpedo	Fired point-blank at Aleph Null. Must be hit immediately. Hits on torpedoes do not effect score.	Fire immediately (i.e. freeze "2" on screen.) Press A to resume.
5	1.0	Supply Ship	Attempts to dock with Aleph Null. If fired upon penalties assessed against gunner. If allowed to dock pays gunner 16 Galactics docking tribute and enough power for 3 additional phaser shots. If hit early supply ships may explode and wipe-out gunner.	No action. Docking tribute and extra shots added automatically, and displayed. If ship hit press A to resume.
6	0.0	UFO	A Hacquerite Shapeshifter which may be either a mine which wipes out gunner if hit or a torpedo which wipes out gunner if not hit. (Nobody said being a First-Class Gunner was easy.)	? If gunner fires and a "2" appears on screen target was a torpedo. Press A to resume.

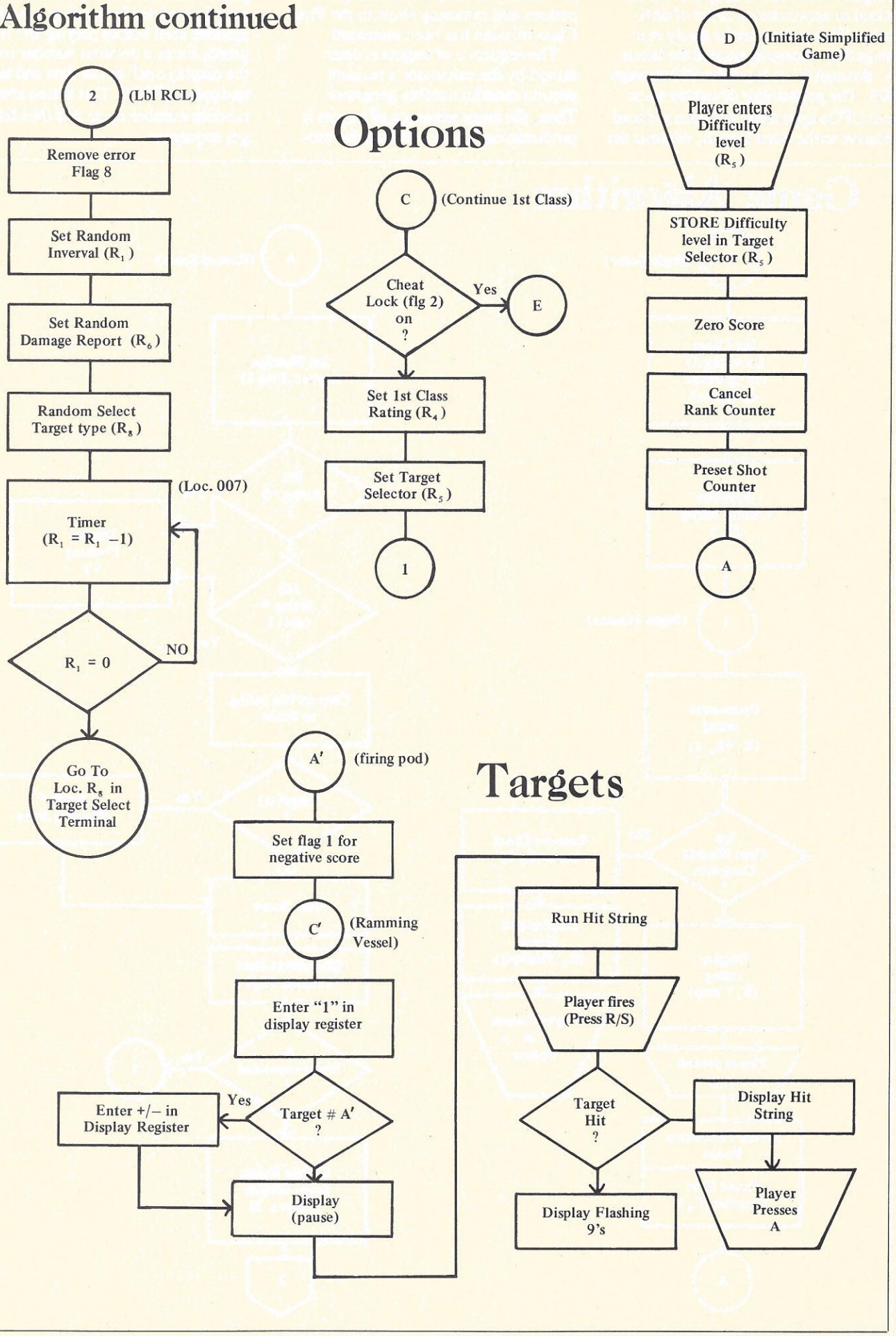
Targets have been arranged in the terminal in approximate order of difficulty. This order may be easily rearranged by changing around the labels A' through E' in locations 000 through 005. The probability of supply ships and UFOs appearing has been reduced relative to the other targets, whereas the probability of the gunner seeing torpedoes and ramming ships in the First-Class mission has been increased.

The sequence of targets is determined by the calculator's resident pseudo random number generator. Thus, the same sequence of targets is produced each time you load the program. This unwanted predictability may be avoided by loading a random number seed before playing the first game. Enter a decimal number into the display such as the date and time, and press STO 09. This action alters the random number cycle and thus the target sequence. □

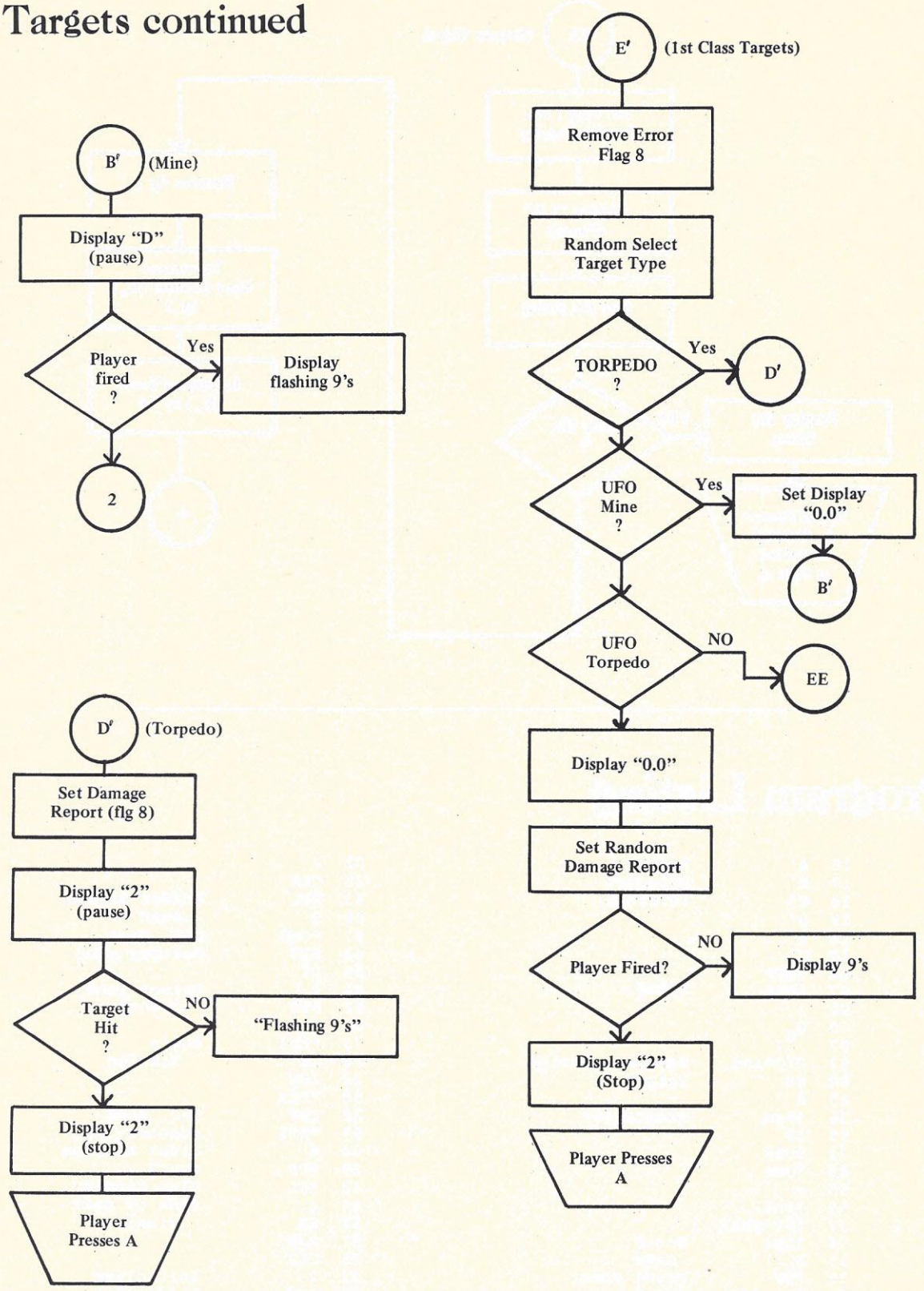
Game Algorithm



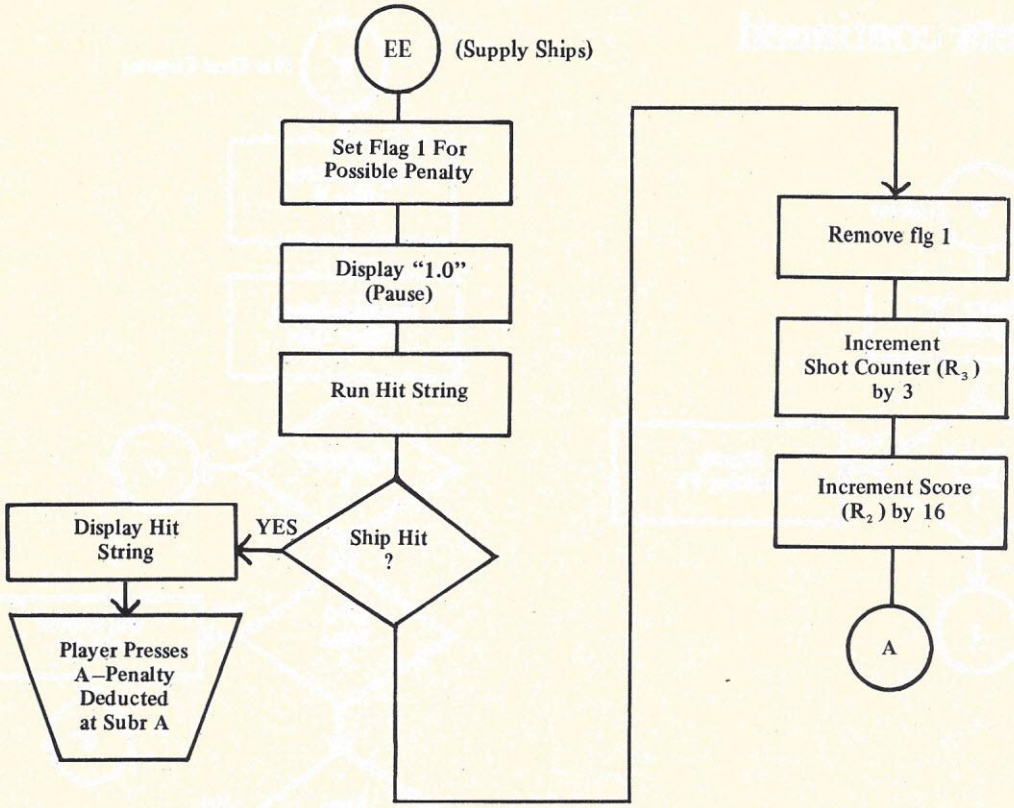
Algorithm continued



Targets continued



Targets continued



Program Listing

```
     16  A'          Target
     17  B'          Selector
     18  C'          Terminal
     19  D'
     10  E'
     18  C'
     68  *NOP
     97  *DSZ        Timer
     01  1
1    00  0
     07  0 7
     83  GTO*Ind     Random selected
     08  08          Target
     65  X
     36  *Pgm        Randomizer
     15  15
     71  SUBR
     88  *DMS
     95  =
     59  *int
2    92  INV SUBR
     76  *Lbl        Begin
     15  E            Game
     22  INV         Reset cheat
     86  *st.flg.     Lock
     02  2
     25  CLR
     43  RCL         Buffer Random
     09  9             seed
     47  *CMS        CLR. Mems.
3    42  STO         Restore seed
     09  09
     04  4           Preset rank
     42  STO           counter
     04  4
     76  *Lbl        Begin
     24  CE            Mission
     22  INV
     58  *Fix
     22  INV         Dec. Rank
4    97  *DSZ        counter-lst
     04  4           class mission
     29  *CP         over?
     43  RCL         Else display
     04  4           rank of next
     52  EE            mission
     91  R/S
     25  CLR
     02  2           Initialize
     44  SUM         Difficulty
```

Program Listing continued

```
5    05  05          Factor
     01  1           Give promo-
     00  0           tion bonus
     44  SUM
     02  02
     07  7           preset
     42  STO          shot
     03  3            counter
     76  *Lbl        Record
     11  A            Score
6    58  *Fix        set Random
     40  *Ind        Damage report
     06  6
     86  *st.flg.    set error
     08  8            flag
     50  lxl
     42  STO         Buffer hit
     06  6            string
     28  *Log        =0 ? flash 9's
     43  RCL         else restore
7    06  6            string
     75  -           string = 1?
     01  1           flash 9's
     95  =
     28  *Log        convert store
     59  *int
     22  INV         Test for
     87  *If flg     negative score
     01  1
     42  STO
8    22  INV         make score neg.
     86  *st.flg.    reset flag 1
     01  1
     22  INV
     76  *Lbl
     42  STO
     44  SUM         sum score
     02  2
     22  INV         Dec. Shots &
     97  *dsz        =0?
9    03  3
     24  CE
     43  RCL         else, collate
     02  2           shots/score
     29  *CP         and display
     67  *X=t
     44  SUM
     69  *OP
     10  10
     65  X
10   76  *Lbl
     44  SUM
     43  RCL
     03  3
     65  X
     93  .
     00  0
     01  1
     85  +
     43  RCL
11   02  2
     95  =
     58  *Fix
     02  2
     66  *Pause      Display
     66  *Pause         score
     66  *Pause
     76  *Lbl
     43  RCL
     22  INV
12   58  *Fix
     22  Inv         Remove error
     86  *St.flg.       flag
     08  8
     01  1           Game Parameter
     05  5           Random Inter-
     71  SUBR           Val.
     00  0
     13  1/3
     42  STO         store timer
13   01  1
     42  STO         store damage
     06  6              report
     43  RCL
     05  5           Select
     71  SUBR           Target
     00  0
     13  1/3
     42  STO
     08  8
14   61  GTO         Goto timer
     00  0
     07  0/7
     76  *Lbl        1st Class
     29  *CP         mission
     58  *Fix        completed
     02  2
     86  *st.flg.    display
     02  2             score
     43  RCL
15   02  2
     69  *OP
     40  40
     91  R/S
     76  *Lbl        Target #1
     16  A'
     86  *st.flg.    Dec. score
     01  1            flg.
     76  *Lbl        Target #3
     18  C'
16   01  1
     22  INV         Test for
     87  *If. flg.   target #1
     01  1           Display
     23  Inx
     94  +/-         -
     76  *Lbl
     23  Inx
     66  *Pause      Display Target
     01  1
17   01  1           Run
     01  1
     01  1           Hit
     01  1           String
     01  1
     01  1
     01  1
     01  1
     01  1
```

Program Listing continued

```
18   01  1
     01  1
     01  1
     01  1
     25  CLR          Flash 9's
     28  *Log
     91  R/S
     91  R/S
     76  *Lbl         Target #2
     17  B'
19   25  CLR
     33  X²
     66  *Pause       Display Target
     28  *Log
     58  *Fix         set damage
     40  *Ind          report
     06  6            (if hit flash
     68  *NOP              9's)
     68  *NOP         delay
     68  *NOP
20   68  *NOP
     25  CLR
     61  GTO          select new
     43  RCL           target
     76  *Lbl         Target #4
     19  D'
     58  *Fix         set Damage
     40  *Ind          report
     06  06
     02  2            display
21   66  *Pause        Target
     25  CLR
     28  *Log         flash 9's
     91  R/S
     91  R/S
     76  *Lbl         lst class
     10  E'           Targets 5 & 6
     22  INV
     86  *St. flg.
     08  8
22   29  *CP
     05  5            Random
     71  SUBR         select target
     00  0
     13  1
           3
     67  *X=t         Target #4?
     19  D'
     75  -
     01  1
     95  =
23   58  *Fix         UFO Mine?
     01  1
     67  *X=t
     17  B'
     75  -
     01  1
     95  =
     22  INV          Supply Ship?
     67  *X=t
     52  EE
24   66  *Pause       else UFO
     02  2            torpedo
     58  *Fix
     40  *Ind         Damage report
     06  6
     68  *NOP
     68  *NOP
     68  *NOP
     25  CLR
     28  *Log         flash zeros
25   91  R/S
     91  R/S
     76  *Lbl         Supply
     52  EE           Ship
     86  *St.flg.     set to Decre-
     01  1            ment score
     58  *Fix         fix display
     01  1
     01  1
     33  X²
26   66  *Pause       Display
     25  CLR
     01  1
     00  0
     00  0
     00  0
     00  0           hit string
     00  0
     00  0
     00  0
27   00  0
     00  0
     25  CLR
     22  INV          Remove
     86  *st. flg.    Decrement
     01  1            Score flag
     04  4            Increment
     44  SUM          shot counter
     03  3
     33  X²           Increment
28   44  SUM          score
     02  2
     11  A            Record score
     76  *Lbl         continue
     13  C            missions
     86  *st. flg.    error
     08  8            flag.
     22  INV          Cheat Lock
     87  *If flg.     on
     02  2
29   15  E            Demote to 3rd class
     02  2            preset lst
     42  STO          class rank
     04  04
     04  4            Preset Diffi-
     42  STO          culty level
     05  5
     71  SUBR         Go to new
     24  CE             mission
     76  *Lbl         Simplified
30   14  D            Game-
     42  STO          record
     05  5            difficulty
     25  CLR          Level
     42  STO          Zero score
     02  2
     42  STO          Cancel rank
     04  04           counter
     07  7            preset
     42  STO          shot counter
31   03  3
     11  A            Begin mission
```

Evaluating Your Options

BY DICK STRAW

Many choices are easy to make. Most of us choose the most comfortable of shirts at similar prices. Usually we try to pick the road with the fewest ruts. Even with a number of factors to consider, one factor outweighs the rest and simplifies the choice. Too often that factor is cost, but it could be many things.

At other times, we find many options and several factors — or several options and many factors — and an objective choice is not easily made just by glancing over the possibilities. A good scheme for evaluating the choices can help, particularly for important choices with long-term effects — like buying a new car. This program is only one of many possible ways, but its simplicity makes it easy to use and effective.

Actually, this program makes two evaluations of each option, then compares options by displaying the total scores for each and their rank scores under each method. The program is implemented by drawing up a table of values for each of the options and factors before beginning. A rating scale weights each factor in each option.

Suppose you wish to compare several new cars you will consider purchasing. Start by making a list of important items you should consider. You might include engine size and fuel economy. Other items might be consumer guide ratings of repair costs, size of interior, trim packages, heater and air conditioning, seat comfort, safety features, colors available, handling, and anything else you consider important. List all these factors down the left side of your page, and make a column for each car type you wish to evaluate. Then choose a simple rating system, say a scale from one to five (either best to poorest or the reverse makes no difference, until you evaluate the results).

Then rate each car by factor according to your scale. Remember, this rating is based on your own particular values, not Cousin Harry's or mine. If you think car A has average fuel economy, give it a three. If fuel economy is really good, give it your highest rating. You need not rate each car type relative to each of the others, although you may. Two cars can have the same rating for fuel economy, for example. Soon your table is full of numbers for each car, all in different orders. Naturally, if you thought one car was best in all the important features you would avoid all this trouble — you'd buy it.

Now you need another table for entering the data in another manner. Put the car types down the left hand side of the page. This time make five columns (if you used a five-point rating scale), headed 5, 4, 3, 2 and 1. Now, go down the column for car A on your first sheet and count up all the fives. Put that number in the proper box on sheet two: car A, column 5. Do the same for the 4s, 3s and so on.

You will probably have something like this:

Rating

	5	4	3	2	1
Car A	4	2	5	1	3
Car B	5	2	4	4	0
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

All the rows should have the same total because the cars were compared on the same number of factors — in this case, 15. Now run the program. You will be asked how many rating categories you used (5) and how many options (number of car types) you rated. After some brief instruction, you will see:

```
NUMBER 1 OPTION NAME ?   (input the name of car A)
RATING 5 = ?
RATING 4 = ?
RATING 3 = ?             (input the number of 5s, 4s and so on)
RATING 2 = ?
RATING 1 = ?
NUMBER 2 OPTION NAME?    (only first ten characters will be
                          accepted)
```

The display shows which option is being processed, then an "E" or "L", while the computer processes the two ranking schemes. At the end, you will get a table of total scores and ranks under the headings EXPONENTIAL and LINEAR.

The linear rating is just a weighted sum of the values and ratings you used. For example, a linear score for car A, above, is:

$$4*5 + 2*4 + 5*3 + 1*2 + 3*1 = 48$$

Exponential weights are a bit different because they exaggerate the differences among the ratings. Each weight is worth 2 raised to a power one less than the rating used: $2^{(R-1)}$, where R is the rating. Thus car A comes out like this:

$$4*2^4 + 2*2^3 + 5*2^2 + 1*2^1 + 3*2^0 =$$

$$4*16 + 2*8 + 5*4 + 1*2 + 3*1 = 105$$

Remember, any number to the zero power is one and any number to the first power is itself. You can see that the higher ratings receive greater importance.

The rating sums are then ranked in the following manner. Under each option, the highest and lowest sums are found. The range of sums (the difference between the highest and lowest) is divided into as many categories as you have specified options. In principle you could get one option rated lowest (1) and each other option rated in order up to the highest rank. In practice there are often ranking ties. You will always have a 1 and an N (where N is the total number of options examined), but no promises in between. Because your original ratings were quite subjective, in most cases, these tie values realistically suggest little difference between options with the same values.

At this point you need to remember whether a rating of 1 was your highest value, in which case the rank of 1 is best. If 5 was your best rating, the highest rank and score are best.

Here's a variation in using this evaluation procedure. In fact, I originally wrote the program when faced with evaluating several proposed routes for a new high-voltage power transmission line. The environmental impact report was just loaded with tables. Numbers, numbers, numbers.

Table 1
Land Use Impact Categories

	Very/High	High	Moderate	Low	Very/Low
Rating	**5**	**4**	**3**	**2**	**1**
Option					
A	0.4	1.6	4.6	21.3	44.8
B	0.9	1.2	7.8	11.4	27.2
C	0.1	0.3	8.1	8.3	31.2
D	0.0	0.1	8.1	8.6	30.3
E	0.2	0.1	7.4	12.4	25.5
F	0.0	0.0	8.0	11.0	27.2
G	0.0	2.1	16.3	0.6	34.6
H	0.3	1.4	14.5	0.7	34.5
I	0.7	1.4	15.8	5.3	29.3
J	0.0	0.1	8.2	10.4	27.6
K	0.0	0.1	8.1	11.5	27.4

Entries are miles of proposed route judged to have indicated land use impact.

One of the tables is abstracted in Table 1. In this case, the ratings were from 5 for very high land use impact (hills, farms or suburbs were in the various routes), down to 1 for very low land use impact. The table values are actually the numbers of miles of the proposed route judged to have the impact specified. Not all of the routes were the same length, but that factor helped us choose among them.

Table 2
Output of Evaluation

	Exponential		Linear	
Name	**Sum**	**Rank**	**Sum**	**Rank**
Route A	125.0	11	105.6	11
Route B	105.2	7	82.7	4
Route C	84.2	1	73.8	1
Route D	80.7	1	72.2	1
Route E	83.9	1	73.9	1
Route F	81.2	1	73.2	1
Route G	117.8	10	93.1	7
Route H	109.9	8	86.5	5
Route I	125.5	11	96.4	8
Route J	82.0	1	73.4	1
Route K	83.84	1	75.34	1

After putting all those numbers into the program, I saw the output results given in Table 2.

As you can see, six of the routes are nearly equal on the measure of land use impact. On the other hand, there were differences among them on other scales, such as visual impact, engineering difficulty, erosion potential and impact on wildlife. For many such scales used to evaluate the same routes, you can average their ranks, since these have been "normalized" on the range from 1 to 11 (in my case), to indicate the best route.

Be careful to run all the scales in the same direction. (In this case, 5 is "worst" and 1, "best".)

The program is written in TRS-80 Level II BASIC. The first line clears space for the string matrix A, which holds the names of the options, then defines variables beginning in I, J or K as integers and A as strings. If you want instructions, answer "Y" or "YES" to the question, "Do you wish instructions?"

Lines 200 to 210 determine the numbers of rating categories and options to be entered, and dimensions of the matrices to hold them:

- Matrix A holds the names
- Matrix V (two-dimensional) holds the values entered
- Matrices E and E1 hold exponential scores and ranks
- Matrices L and L1 hold linear scores and ranks.

Line 320 chops off for use the left-hand ten characters of the name. Lines 410 to 450 compute the weighted sums.

The routines from 500 to 620 and from 700 to 820 do the same things for the exponential and linear scores, respectively. They could have been combined into one routine, but they seemed easier to understand this way. Each routine first finds the largest and smallest values, divides the difference into the proper number of categories, then evaluates each score and give the proper rank value. You can save space by making E1 and L1 into integer vectors, say JE and JL. Lines 1000 and beyond print the output table.

Caution: do not use this program to compare your microcomputer to others you might have bought. Why be needlessly unhappy? □

Program Listing

```
5    CLEAR 5000: DEFINT I,J,K: DEFSTR A
6    CLS
10   PRINT "EVALUATING YOUR OPTIONS"
20   PRINT TAB(20);"PROGRAM BY DICK STRAW, 1979"
30   PRINT: INPUT "DO YOU WISH INSTRUCTIONS (YES/NO)"; A1
40   IF ASC(A1)<> 89 GOTO 200
50   PRINT: PRINT"   THIS PROGRAM CALCULATES THE COMPARATIVE
VALUES OF"
60   PRINT "EACH OF SEVERAL OPTIONS AVAILABLE ACCORDING TO
RATINGS OF"
70   PRINT "COMPONENTS OF EACH OPTION."
80   PRINT "  YOU WILL INPUT FOR EACH OPTION THE NUMBER OF
FACTORS OR"
90   PRINT "UNITS THAT FALL IN EACH OF THE RATING CATEGORIES
YOU USE."
100  PRINT "ANY NUMBER OF CATEGORIES OK; FIVE IS A GOOD NUMBER"
105  PRINT "ALL NUMBERS SHOULD BE POSITIVE."
110  PRINT "ANY NUMBER OF OPTIONS OK (BUT CLEAR N IN STATEMENT
5 MAY"
120  PRINT "NEED TO BE INCREASED FOR LARGE NUMBER."
130  PRINT "  OUTPUT IS A TABLE OF WEIGHTED SUMS AND RANKS FOR
EACH"
140  PRINT "COMPUTED AS LINEAR OR EXPONENTIAL (BASE 2) WEIGHTS"
150  PRINT "RANKINGS IN TOTAL POSSIBLE CATEGORIES. TIES POSSIBLE."
160  PRINT "    PRESS ENTER TO CONTINUE";
170  INPUT A1
190  REM DIMENSION MATRIX V = VALUES, A = NAMES
200  CLS: INPUT" HOW MANY RATING CATEGORIES DESIRED";K2
210  INPUT "HOW MANY OPTIONS WILL YOU EVALUATE"; K1
220  DIM A(K1),V(K1,K2),E(K1),E1(K1),L(K1),L1(K1)
230  PRINT "FOR EACH OPTION ENTER VALUES FOR EACH RATING"
240  PRINT "AS REQUESTED.  FOR OPTION NAME, LIMIT OF 10
CHARACTERS"
250  PRINT "NO PUNCTUATION IN NAME, PLEASE"
260  FORI=1TOK1:E(K1)=Ø:L(K1)=Ø: FORJ=1TOK2:V(I,J)=Ø:NEXTJ,I
280  PRINT: PRINT
300  FOR I = 1 TO K1
305  PRINT "NUMBER ";I;
310  INPUT "OPTION NAME ";A1
320     A(I) = LEFT$(A1,10)
330  FOR J = K2 TO 1 STEP -1
340     PRINT "RATING ";J;
350     INPUT "="; V(I,J)
360  NEXT J,I
390  REM CALCULATE EXPONENTIAL (E) AND LINEAR (L) WEIGHTED S
400  CLS: PRINT@ 340,"WORKING"
410  FOR I = 1 TO K1 :  PRINT@ 408,I
420  FOR J = 1 TO K2
430     E(I) = E(I) + V(I,J)* 2↑(J-1)
440     L(I) = L(I) + V(I,J) * J
450  NEXT J,I
500  REM CALCULATE RANKING FOR EXPONENTIAL VECTOR, E1
505  REM MX = MAX, MN = MIN, R = RANGE/NBR OF OPTIONS
510  PRINT@ 408,"E  "
520  MN = 1E10 : MX = -1E10
530  FOR I = 1 TO K1
540     IF E(I)< MN THEN MN = E(I)
550     IF E(I)> MX THEN MX = E(I)
560  NEXT I
570  R = (MX-MN)/K1
580  FOR I = 1 TO K1
590    T= E(I) :  E1(I) = K1
600       FOR J = K1-1 TO Ø STEP -1
610         IF T< MN + (R*J) THEN E1(I) = J
620  NEXT J,I
700  REM  NOW LINEAR RANKING, L1
710  PRINT@ 408,"L  "
720  MN = 1E10 :  MX = -1E10
730  FOR I = 1 TO K1
740     IF L(I)< MN THEN MN = L(I)
750     IF L(I)> MX THEN MX = L(I)
760  NEXT I
770  R = (MX-MN)/K1
780  FOR I = 1 TO K1
790    T = L(I) :  L1(I) = K1
800       FOR J = K1-1 TO Ø STEP -1
810         IF T< MN + (R*J) THEN L1(I) = J
820  NEXT J,I
1000 REM  PRINT OUTPUT
1010 CLS: PRINT TAB(20);"EXPONENTIAL";TAB(40);"LINEAR"
1020 PRINT "NAME";TAB(18); "SUM"; TAB(27); "RANK"; TAB(38);
"SUM"; TAB(47); "RANK"
1030 PRINT
1040 FOR I = 1 TO K1
1050 PRINT A(I); TAB(18); E(I); TAB(28); E1(I); TAB(38); L(I);
TAB(48); L1(I)
1060 NEXT I
2000 END
```

The inevitable mass market of microcomputers will arrive sooner with a little help from the hobbyists.

Spread the Word, Fellow Hobbyists!

BY BILL PARKS

The current owners of microcomputers are the true pioneers in this new field. There is a need for them now to go out and sell the public on personal or home computing. One can raise questions: "Why should the microcomputer hobbyist have to do such a thing?" or "How can the popularization of home computing help the hobbyist?"

Altruism or a selfless concern for the welfare of others often requires motivating factors. Let's consider a few important reasons for selling the general public on home or personal computing:

1. The nation as a whole will benefit. When the general population discovers and starts using computers, you will see a rise in the levels of intelligence and forms of logical thinking. More learning will take place in the home in addition to what is already taking place there. This added dimension is sure to raise the educational level of our society.

2. A massive acceptance of home computing will have a unifying influence on society. At the same time it will stimulate individual expression or original and creative uses of these programmable devices. Such unifying effects are greatly needed in our current fragmented society. Half the people seem to be on the move. Moving into a neighborhood of other computer people could bring about instant common interests. The microcomputer — as little as it is — can have a big impact on our society by bringing together people with similar interests.

3. Almost everyone agrees that the family is a vital force in any nation, and the well-being of family life is important. Home or hobby computing can reactivate common family life, which seems to be weakening if you follow teen-age crime reports in newspapers. Particularly, I can think of that important father-son relationship. Home computing gives everybody a chance to do something together. Interactive chess games, for example, can match the wits of a father and son against the program in the computer. It stimulates discussion on strategies for attacking the enemy king and destroying the computer's offense. Home tutorial programs can ease the burden of learning new facts and help children perform better in school. Happy children doing well in school contribute to family life with positive attitudes and self-respect.

4. Increased consumer-generated demand for hardware and programmed software will bring down the costs of both. Companies will invest more in programming efforts. They will enhance the hardware with more features as more money is spent by a very large consumer public. This mass market popularization will help the hobbyists in many respects.

5. The more people who become involved in writing programs the more ideas will be generated from their efforts. In a relaxed atmosphere of the basement study or workshop many original computer programs will emerge. Millions of home computers can generate millions of new ideas. There will be multitudes of programs published each year. In fact, the number of new programs might surpass the number of new book titles that appear on the market throughout the year.

Microcomputer hobbyists are part of the historical beginnings of the home computer movement. As mentioned before, they are pioneers like the first radio operators. However, I think that this technology is more significant than anything invented by man thus far. Until a few years ago, large scale centralized computing centers were accessible to only a few specialized users. Now the first hobbyists and some consumers supported by a new industry are proving that the awesome power of computers on a personal level in the home is feasible at a reasonable cost.

If the inevitable mass market is to develop sooner, the hobbyists can play a very important role. Now that we have established some motivating factors, let's consider what the hobbyists might do to promote the home computer movement.

The first people to contact should probably be your neighbors. Invite them as guests to a party in which you can display the entertainment qualities of the system. Another idea is to encourage your children to invite other neighborhood children in for some interactive play. If the Jones' want to keep up with you, they will have to buy a similar, or better, computer system for their sons or daughters. Remember that every sale helps to bring down the costs for software and hardware that you may now want but can't afford. So don't get jealous. His purchase, no matter how large, will help you in the long run. Besides, he'll probably want you to assist him. You can become the neighborhood expert. Offer your services. Who knows, you might receive a needed favor in return someday. Perhaps, you can even tutor children and earn enough to buy your own hardware or programs.

Some of the older hobbyists might remember how the neighbors would congregate in the house of the first member in the neighborhood to get a TV. If you are the first on the block with a micro, invite the rest over and demonstrate your equipment. If every hobbyist in the country did this in one week, I'll bet sales of home computers would dramatically increase in the following weeks.

If we work together for a common purpose we can stimulate change sooner than expected. Remember that the home computer movement is bigger than any one company or interest group.

Next, the hobbyists should become involved in public-school activities. There are many things that can be done. Attend a PTA meeting. Offer to demonstrate educational aspects of the microcomputer system. Even though there has been some advertisement on TV, the public is still not fully aware of the great potential for education. Add to this the taxpayers' revolt and it becomes more imperative to seek funds from PTA-type organizations if we ever expect to see microcomputers adopted in some schools. The less affluent districts may acquire microcomputers for classroom use only through PTA support. Organize bake sales or raffles to provide money for microcomputer purchases in elementary schools, junior or senior high schools.

Offer to teach a course on BASIC and "hands-on" microcomputers in adult education programs. Use your system to demonstrate its usefulness. You might benefit by getting paid for teaching these courses and you also benefit in the long run by promoting this new technology among citizens in the community in which you live.

Visit nursing homes or retirement centers. The recreational directors might not fully realize the entertainment value of microcomputers — especially to senior citizens. Urge directors of senior-citizens centers to acquire at least one system that can be shared by all the members of the center. It can be a wonderful new experience for older Americans who have lost interest in their uneventful lives. I think that every senior-citizens center should have a room full of microcomputer systems with programs on chess, checkers, education, personality counselling, poker, bridge, conversation, etc.

The YMCA and other recreation centers might be persuaded to provide microcomputer services for their members. People's computer centers can be set up for the children of disadvantaged or less affluent families that are unlikely to have home computers. The more wealthy hobbyists might even consider donating inexpensive systems to charitable or nonprofit organizations. The possibilities are endless, just as the horizons in the West once seemed endless to early American pioneers.

We now have weekly meetings of Boy Scouts, sports and other activities. Perhaps the time has come to have computer youth clubs. Be the first in your city to organize one! The kids interested in computers will always remember your efforts on their behalf. In case you don't know how much interest the kids have in computers, the next time you go to a computer fair, notice who hogs the keyboards for hours at a time.

One place where hobbyists can devote some time is at hospitals. I know one person in a VA hospital who is totally paralyzed. He has to lay still all the time. The dental department constructed a special stick device for his mouth which allows him to operate the keyboard of a TRS-80. He is now able to enjoy the excitement of personal computing and his mind remains very active in a worthwhile undertaking of learning to program. There are many people like him who can benefit from the stimulating therapy of using computers in hospitals. This can add interest to the lives of patients who might ordinarily be spending boring hours at less challenging activities. Many handicapped persons can even be served by home computers. Let's alert hospital authorities to the wonderful therapeutic value derived by getting patients to use their minds in interesting mental exercises when they become too weak to do physical work. Sure, these people have access to TV, but most persons agree that this is a passive medium with many negative aspects. The interactive and interrogative uses of microcomputers far excel TV in these respects.

"Home computing gives everybody a chance to do something together."

Computer clubs have been organized in many parts of our country. Many are active in promoting microcomputers for home uses. Some of the activities involve displaying equipment at minifairs held in school gyms, shopping malls, YMCA's, and clubs. These fairs don't have to be elaborate. Small and personalized exhibitions are very effective in attracting the attention of potential home buyers. Often people just want to talk to microcomputer users. They want to learn first hand what it's like to own a computer system. The public is ready for home computers. However, the public wants motivating circumstances. The computer club is one reason for buying a computer. It's a place to meet people and discuss a common interest. Start a computer club if none exists in your area or city!

Furthermore, hobbyists can exert some influence on manufacturers of hardware and software. You can write letters, make phone calls, and go to retail outlets where you can engage in discussions with managers and factory reps. Perhaps the time has come to organize a hobby lobby! A lobby, such as this one, might insure high standards in products.

The best promoter of home computers is the machine itself. Reliable hardware is needed for full acceptance by the consumer. A computer built for home use should last at least as long as a washer, TV, or refrigerator. And it shouldn't cost any more than these appliances. Hobbyists should advocate such a philosophy among the manufacturers. My final suggestion is that hobbyists can write letters and lobby together for the common good.

Another letter writing effort could be directed to manufacturers and software houses. They could be encouraged to organize contests for awarding best programs with prizes. The software is the heart of the home computer. Without good software, produced in great quantities each and every year — this movement can't possibly convince the mass market of the need for home computer systems. Efforts of programmers of good software should be rewarded with annual awards, grants, and top royalties. Such incentives will keep the flow going of new or novel software. Therefore, in letter writing, hobbyists should constantly urge companies to play the role of an academy of manufacturers looking out for the industry of home computing at large. □

HARRY SHERSHOW – Dept. Editor
MORRIS MILLER – Chess Annotater

Man Against Computer

The "Globe" is the largest daily newspaper in Boston, Mass. Chess editor of that newspaper, Harold Dondis, recently wrote an editorial opinion in his column stating that computers cheat and should be barred from human competition. He says, in his declamation:

"I have proposed that chess computers be eliminated from human tourneys. This is not a spoilsport fear of computers. Quite to the contrary. I have always predicted that computers will eventually beat human beings.

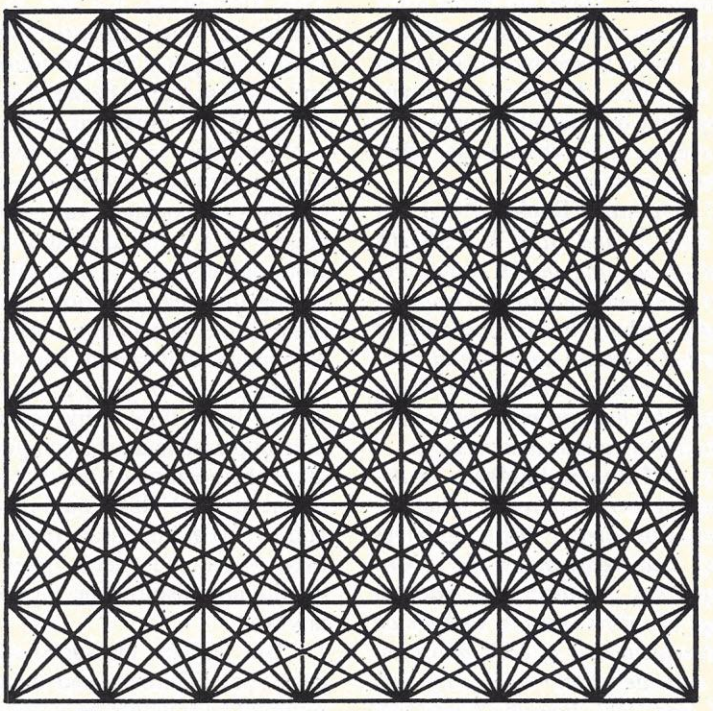
"Having studied artificial thinking in depth — and taught it — I felt that the fantastic speed of a computer would be decisive. However, a computer is simply an extension of man's intelligence. For this reason, although many chess players fear the development of the computer, I hope the computers will beat humans, as soon as possible.

"But human chess is based on innovative thinking under cognitive strain. Computers cheat at chess, for they violate rules requiring cognitive strain. They cheapen human competition, in the same way that use of an automatic pitcher would take all the fun out of baseball and violate its rules, yet would create better pitching.

"Since computers are illegitimate though appearing to be legitimate, they are hurting the game. Since there are plenty of computers to play each other and matches can be arranged with human players, there is no longer any adverse effect on science by barring computers. And this should be done forthwith."

The Dondis pronouncement is certainly not new to chess circles. It is echoed and argued in every chess hall in the world, and stirs up a new wave of murmurings whenever David Levy, perennial computer antagonist, sits down opposite a terminal to take on (and drub) a computer-chess program.

One response to the Dondis statement came from Professor John McCarthy, Director of Computer Science, Stanford University. He writes: "First of all, Professor I.J. Good is certainly right when he says that for a computer to move the pieces in *its* memory is no more cheating than for a human to move them in *his* memory, which is what Harold Dondis suggests. As to whether computers should be barred from human tournaments, it seems to me that this is a matter of expediency. When the human chess players no longer find it interesting to play against machines, then they should be barred. Neither the programs themselves nor the programmers have any special rights in this matter. It seems to me that when machines win most of the time, the chess players will *want* to bar them or at least restrict them. It would be interesting to try to formulate a restriction on the amount of computing the program is allowed to do to decide on a move, but it wouldn't be easy in the present state of computer science. Artificial intelligence would benefit from the ability to compare how clever a program *is* apart from how fast it is."



The 1840 possible moves on a chess board as tracked by Dr. I.J. Good. (Reproduced with permission of Dr. Good.)

Lane Jennings is Research Director of the World Future Society, "An Association for the Study of Alternative Futures". The Society is a non-profit, educational and scientific organization founded in 1966 to study "what will happen or what should happen in the future." Its superb bimonthly magazine THE FUTURIST (published by World Future Society, 4916 St. Elmo Ave., Washington, D.C. 20014) is a clearinghouse for a variety of views on the future by various authors. In June 1978, Jennings wrote an article in The Futurist entitled "Computer Chess: Can the Machine Beat Man at His Own Game?" His excellent article on a controversial subject ended with the provocative observation: "The idyllic picture of a man/machine partnership can only become a reality if humans are able to overcome their fear and envy of machine intelligence. This is far from certain, however, for human egos are notoriously sensitive and at first glance computers can be overpowering. How the world's chess players react to the growing impact of computers — both large and small — on the theory and traditions of their 'Royal Game' may provide a glimpse to the future of mankind's relationship with the machine."

In particular response to the Dondis statement, Jennings offers the follow-

ing comments: "Dondis has a point, I think, but I don't agree with him that computers should be banned from regular tournaments. There are better ways to deal with the unfairness and potential danger to chess posed by pairing man against machines. As I see it, computers enjoy three distinct advantages over human opponents in chess under present tournament rules:

"1. **Opening Books.** *Programs like BELLE and BLACK KNIGHT boast of opening books containing many thousands of moves. The process of searching through this mass of recorded material has more in common with* reading *than with remembering. But humans may not consult books during a tournament game.*

"2. **Off-Board Analysis.** *In deciding on its next move, a computer 'touches the pieces' (as it perceives them) and rearranges the board many times. In effect, the machine brings all of its 'senses' to bear on the consequences of each move under consideration — it can both 'see' and 'feel' how the board will change after a certain sequence of moves. Humans may neither touch the piece on the board, nor use a second chess set for analysis between moves. Rather than the computer 'playing blindfold,' it is actually the human player who is under a handicap, by being denied the information from hand and eye that would help verify whether a line of play is sound or unsound.*

"3. **Isolation.** *The noise, heat, crowding and poor lighting conditions disturb human players at tournaments. But the computer is playing in a quiet, isolated, climate-controlled environment, where it is constantly tended by skilled servants who do all in their power to see that nothing occurs that might break the machine's concentrations on the game at hand.*

"But far more serious than these 'unfair' advantages are the damaging effects that computers could have on the style of human chess in the future. At the present level of development, computer-chess programs may not be able to match the strategic grasp of top-rated human players. But they can, and do, often excel at sharp tactical play.

"Banning computers from tournaments would only mean *ignoring* problems rather than trying to solve them. Two alternatives I'd like to see explored are: 1) new rules to cover human versus computer play in tournaments, and 2) chess games between teams consisting of men plus their computers.

"Consider, in the first instance, allowing a human player to consult books or notes one or more times during the course of a game against a computer. Both players' clocks might be stopped during this search period. This would reduce the machine's opening-book advantage and avoid penalizing the human player for being a 'slow reader.' At the same time, why not allow the human paired against a computer to analyze the position on another board *between* moves? This would permit hand and eye to aid the brain (even Einstein used paper and pencil, after all) and would not disturb one's opponent in any way.

"But perhaps the surest way to escape the unfairness and dangers I've outlined here would be to look beyond simple man vs. computer confrontations. There should be a new kind of tournament play between *pairs* of man/machine chess teams as in my second instance. Each human player would have a computer as a partner, and could decide at each move whether or not to rely on the computer's judgment. Pairing human strategy and 'common sense' with the computer's memory for details and 'calm deliberation' might rapidly produce a very high level of tournament play. Fewer games would be marred by gross blunders or 'swindles,' and this would encourage more players to venture into highly complicated tactical situations — exploring new ground and offering real excitement to the world-wide audience of those for whom chess is an artform.

"Finally, I see no simple way to compensate for the computer's indifference to the stress of tournament play — which appears to be Mr. Dondis' principal complaint. But this so-called advantage has a negative side as well. Though the computer has no fear of failure, and can't be distracted by a crowd of kibitzers, it can take no pleasure in victory or applause. The machine would just as soon be paying bills as playing chess. Being human may hurt more, but it also offers *more*. If the goal is good chess, I'm willing to bet that man *with* machine can outplay man or machine alone now and for the foreseeable future. Why settle for Bobby Fischer vs. BELLE when we could get Fischer *plus* BELLE against Karpov plus KAISSA? Or how about you and the new BORIS vs. me and the new CHESS CHALLENGER? And may the best companions win?"

Professor I.J. Good, University Distinguished Professor of Statistics at Virginia Polytechnic Institute and State University, comments:

"At first sight, Harold Dondis' analogy with an automatic pitcher in baseball appears reasonable, and it may become reasonable eventually but I don't think that time has yet arrived. At present we are still interested to see what level of chess can be achieved by computers, and entering them in human tournaments will help to answer that question. This applies both to the big computers and to the small chess-playing machines. The decision of whether to buy one of these small machines depends on how well they play and the best way of finding out is by entering them in *human* tournaments so that they will acquire USCF ratings. For the big machines, we want to know whether genuine planning and the flexible handling of descriptions is necessary in computer programs if they are ever to win the world championship. (Of course 'randomized chess' or 'prechess' must be used to preclude the nonsense of storing the openings.) We also want to know whether programs can be written that handle descriptions like a human.

"The corresponding question for a baseball pitcher has an obvious answer known already: it would be easy to build one like a gun that would bore a hole through the baseball bat!"

John Larkins, like Harold Dondis, is a chess editor. He shepherds CHESS VOICE (publication of Northern California Chess Association) considered to be among the best of such publications in the country. "I find the subject of Dondis' article an interesting one, worthy of discussion and debate," he writes. "But I do not think it is a simple one. He states 'this is not a spoilsport

fear of computers and although many chess players fear the development of the computers, I hope the computers will beat humans, as soon as possible.' Because Dondis also mentions that he has taught the subject of artificial thinking, one cannot, therefore, attribute to him a naive fear of machines. It is amusing to see Professor Jack Good expressing an exactly opposite fear of humans when he points out that eliminating the storage of opening variations in chess playing machines 'would give humans an unfair advantage.' It strikes me that a very simple point is being missed in all this verbiage. Like any game, chess has a set of rules. These rules have all evolved from games played by people and are based on human characteristics. When an attempt is made to apply these 70-pages of rules to chess-playing machines, some fit and some do not. Machines are not people and they compete over the chessboard in a very different way — in a way never remotely considered when the rules were first established.

"So, from a technical point of view, Dondis is automatically correct: 'computers cheat because they are incapable of observing many of the specific laws of chess .' He is further correct in stating that 'chess is based on innovative thinking under cognitive strain.' The rules relating to time pressure, prohibition of access to books or notes or physically moving the pieces or consultation with others, and so on, are all designed to put both human players in a game under the same cognitive strain. This kind of cognitive strain simply doesn't exist in chess-playing computers — so, no competition in this context is possible. Of course, computers have their own problems — enough at present to roughly compensate for their inhuman speed and memory. But the computer decides on its move in a very different manner than the human decides on his (and by using very different 'equipment.')

"Tournament chess is a very human activity, which tests physical endurance, fighting spirit, the ability to concentrate, the degree of pre-tournament mental and emotional preparations, the ability to function under time pressure, and the capacity to come back from defeat and to keep doing all of these things round after round. Specialists in the field of artificial intelligence tend not to understand just how physical and emotional tournament chess really is and thus they miss a major part of what the competition is all about."

Dr. M.V. Donskoy, on the Russian team of KAISSA, offers a terse comment: "I have no strong opinions on this issue of 'cheating' by computers in chess. It seems to me to be a misunderstanding of both the nature of humans and the nature of computers."

Monty Newborn, Professor of Computer Science at McGill University, stated at the 9th ACM Computer Chess Tournament in Washington: "Will the human chess player accept computer chess as a friendly development within the concept of human progress and intellectual advancement? Or will hostility break out between man and machine?"

The preceding comments indicate that although the seeds of hostility have already been planted, there is a good possibility of an agreement that will be of mutual benefit to everyone.

Writing a Chess Program Part XIII

This complete dissertation by Mike Valenti on how to write a computer chess program is presented in monthly sections as a guide to those wishing to write their own programs. Although designed to be run on a large computer, this program with proper modifications can also serve as a model in writing a chess program for smaller memory-systems — even the microcomputer. This program is written in BPL (modified XPL), but it can be written in other languages as well — with proper transitions.

Book Openings

At present, the program has a simplistic facility for accessing book opening moves. A more extensive facility would help a great deal in preventing the program from getting into trouble in the early going, which it can and does get into.

The proposed format for this is to create a procedure called BOOK OPENINGS which is supplied with the current board vector and side-to-move which returns true if the search is successful and false if not. If the search is successful, the variable BEST MOVE should now contain the book move (see "main control code" in upcoming Appendix K).

The initial data structure generation and plausibility analysis would have already been done before look-ahead is called. The data structure is required for the legality checker routine, since this routine checks *all* moves for legality, even those generated by the program (at this time). At present, the book opening are checked for immediately before look-ahead is done.

In this form, a check should be made in BOOK OPENINGS that it is the machine's turn, otherwise return false. Also at some point in the game (i.e., as soon as a book move is not found) the program should not bother looking at the book openings anymore.

Position Library

This program has no memory, in that it does not remember seeing the same position again, and must re-evaluate every time. This is a big drawback in that given the same game parameters, it cannot learn from its mistakes. If a position library existed, the program might be able to see that a certain move led to a material loss or checkmate shortly thereafter, and making the same move could be discouraged in the future.

A position library can be incorporated into the book openings routine, but additional routines would be required to add and update position information.

It could include positions generated in the look-ahead tree. Information regarding the depth and width of search and best backed-up move from this position might be included in the library. Likewise, some post-game analysis should be done to see what moves led to bad positions for the computer, and their attributes adjusted accordingly.

A position library can be a lengthy and involved problem, but it should be easy to work into the basic framework of this chess playing program.

Chess Teaching Program

Another possible extension that seems feasible is to have a chess teaching mode in the program. Such a program could be used to teach a novice the basics of chess, and in more advanced play, show a player where he went wrong, or what factors he may have overlooked in a complicated situation.

To teach the basics, the program could acess text files that explain the basic rules and strategies. To teach openings, the program would require a large book (similar to the one for regular play) which contained more information regarding the hazards of not following book play. For instance, a sequence of moves could be saved showing the results of a move proposed by the chess learner, or general information regarding poor development or weak points could be displayed. This part of the program would mainly require large text files describing the ins and outs of various opening positions.

Once the program gets out of the book, it must analyze the moves on their own merits. A number of things could be checked when the player makes a move. If the move looked good at the first level and did not look good after look-ahead, the program could display that part of the game tree and show how this move leads to a bad position. Also this "bad" position would have to be described (i.e., "the king will be pinned by the bishop," or "pawns are now tripled up," or "the castling pawn structure is very weak").

If a move looked weak to the program at the first level, then the heuristic values could be checked to see which factors made the move look bad. It could also propose a better move and show which factors led to a better position in look-ahead.

The first part of this type of program is fairly straight-forward and consists mainly of the basics of the game and book openings. The programmed analysis is more complicated and involves, in effect, making the program tell the player what it knows.

This is the exact opposite of how the program was developed. Instead of being "told" how to play by programming heuristic and look-ahead strategies, the program uses these tools and "programs" the player to play the computer's style of game.

There seems to be many possibilities in this area, including extending the program to "teach" and improve itself from past experience or even playing itself and analyzing these games. Any of these schemes would require a position library similar to the one described earlier.

Scuffle in a Corner

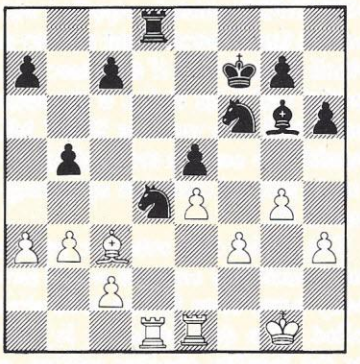
During the 9th ACM tournament in Washington, there were minor scuffles going on in corners. Some of the restless "standbys" were attacking some of the regular programs. A "standby" was a program that had been accepted for the tournament but would only have a chance to participate if any of the regular 12 entrants were unable to appear or unable to continue. One such standby was "BB-1." It is the work of Tony Scherzer who was responsible for writing the operating system, assembler, macro library and applications software for Singer System-10. The chess program BB-1 was the culmination of many hours of writing and rewriting on the part of both Tony and a fellow programmer, Dan Potochniak. A good chess player, Dan has functioned as the principal critic of Tony's chess effort. The two play five to ten games a week, probing for weariness in the chess player. During these meetings, changes are made in the source programs, bugs are located and corrected and modifications are introduced to improve the game. Tony came to the ACM tournament with a small, brown briefcase in hand. The briefcase, it turned out, contained the hardware components for Tony's tightly designed unit, BB-1. During a lull in play between rounds, Tony had a chance to pit BB-1 against Kathe Spracklen's Sargon II. The game that the two played is documented in this section.

Game 1. Sargon (white) vs. BB-1 (black)

1.	P-K4	P-K4
2.	N-KB3	N-QB3
3.	N-QB3	B-B4
4.	B-B4 (a)	P-Q3
5.	P-Q3	N-B3
6.	N-KN5?	0-0
7.	N×BP?	R×N
8.	B×Rch	K×B (b)
9.	0-0	B-KN5
10.	Q-Q2	P-Q4 (c)
11.	P-KR3	B-K3
12.	Q-N5	P×P
13.	P×P	P-KR3
14.	Q-Q2	N-QN5
15.	R-Q1	Q-Q5 (d)
16.	Q-K2	Q-B5

Position after Black's 27th move

White — SARGON Black — BB-1



17.	Q×Q	B×Q
18.	R-Q2	R-K1
19.	P-QR3	N-B3
20.	R-Q1	P-QN4?
21.	P-QN3?	B-Q5
22.	B-Q2	BxN
23.	B×B	B-K7 (e)
24.	R-K1	B-R4
25.	P-KB3	R-Q1
26.	P-KN4	B-N3
27.	R(QR1)-Q1	N-Q5 (f)
28.	B×N	PxB
29.	R-Q3	K-K3
30.	P-QB3? (g)	K-K4 (h)
31.	P×Pch	K-B5
32.	R-QB1	R-Q2
33.	R-QB5	P-QR3
34.	R-B6	K-N6
35.	R×P (R6)	P-B4
36.	P-Q5	K×P

37.	R-B6	P-B5
38.	P×P	P×P
39.	R×P	B-B2
40.	K-B2	R-QN2
41.	P-R4	K-R5
42.	K-K3	K-N6
43.	P-R5	R-R2
44.	R-R3	N×P
45.	P×N	B×P
46	R-Q4	B×P
47.	R(R3)-R4	R-K2ch (i)
48.	K-Q3	R-K3 (j)
49.	P-N5	B-K7ch
50.	K-Q2	P×P
51.	R-K4	R×R
52.	R×R	B-R4
53.	P-R6 and won.	

Annotations –

(a) 4-N×P, N×N;5-P-Q4 is the pre ferred line.

(b) Black's chances are better because of having two pieces for the rook, giving black two units to attack with against white's one. The pawn does not play a role in the middle game.

(c) Better is Q-Q2 followed by R-KB and K-N. Opening files will favor the side with the two rooks. Also, 10-. . .Q-Q2 prevents 11-P-KR3 which is answered by 11-. . .B×RP; 12-P×B, Q×P, 13-any, N-KN5, etc.

(d) Black could here or on its 18th move win a pawn: 15-. . .Q×Q; 16-R×Q, B-Q5; 17-P-QR3, B×N; 18-P×B, N-R7; 19-B-N2, N×KP, Rook moves, N×QBP, etc.

(e) 23-. . .N×P almost works: 24-R-Q-7ch, R-K2; 25-R×Rch, K×R; 26-B-N4ch, N×B; 27-P×N, Bishop moves, 28-R×P, etc.

(f) Theory in this position calls for exchange of a pair of rooks and mo bilization of black's pieces. Hence: 27-. . .R×R, 28-R×R, K-K1 followed by B-B2 and a holding position. If white should play B-N5, black must not exchange as this would open the rook file for white.

(g) If 30-. . .P-B4; 31-P×P, P×P; 32-R-QB1, etc. However, white's strongest is 30-P-KB4! to prevent the king from infiltrating. If 30-. . . B×P; 31-P×N5; if 30-. . .N×P; 31-P-B5ch, etc.

(h) Nothing helps; if after 31-P×Pch, R×P?; 32-P-B4ch wins.

(i) Time wasting. Black must get the king side pawns moving.

(j) B-K7ch prevents the move P-R6. White give up a pawn to exchange rooks.

Not a very impressive ending by either side.

—BY MORRIS MILLER

Committees for ICCA

. . . Finally evolving into an organized group, the International Computer Chess Association has inaugurated its new image with the appointment of various individuals to serve on different committees.

BYLAWS COMMITTEE (to propose ICCA rules):

Monty Newborn (Chmn.)
School of Computer Science
McGill University
Montreal, Quebec, Canada

Kathe Spracklen
10832 Macouba Place
San Diego, CA 92124

TOURNAMENT COMMITTEE (to develop rules and procedures for tournaments):

Tom Truscott (Chmn.)
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Fred Swartz
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Micha Donskoy
Institute for System Studies
Ryleyeva 29
Moscow, USSR

EXTERNAL LIAISON COMMITTEE (to contact other organizations to determine ICCA's role):

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David Slate
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CHESS RATING COMMITTEE (to help develop a rating system for chess programs):

Allan Gottlieb (Chmn.)
York College — Math Dept.
City University of New York
Jamaica, NY 11432

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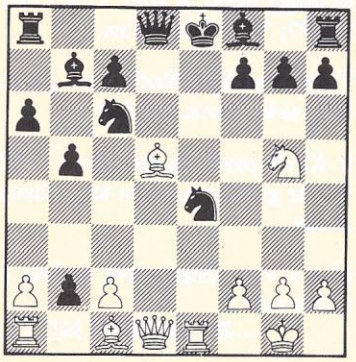
Control Data Corp.
4201 Lexington Ave., N.
Arden Hills, MN 55112

Any suggestions on this ICCA organization project will be welcomed by the various committees. A strong, international organization can emerge with the support and cooperation of members as well as others interested in this exciting activity.

Mate against 2 Queens

. . . Evan Katz submits an unusual game he played against CHESS CHALLENGER0-10 in which he mated the machine at level 5 in 13 moves and at a point when CHESS CHALLENGER had two Queens on board. The game, with Evan Katz's comments, follows:

White — KATZ	Black — CC-10
1. P-K4	P-K4
2. N-KB3	N-QB3
3. B-N5	P-QR3
4. B-R4	N-KB3 (a)
5. 0-0	P-QN4 (b)



6. B-N3	NxP (c)
7. P-Q4	PxP (d)
8. R-K1	P-Q4 (e)
9. N-QB3	PxP (f)
10. BxQP	B-N2 (g)
11. N-N5	PxP (h)
12. NxN (i)	PxR=Q (j)
13. N-B6	Double Check Mate

(a) The first four moves are out of CC-10's book and are played quickly.
(b) The Challenger took 3 minutes 41 seconds for this move.
(c) Five minutes,one second here.
(d) Six minutes 20 seconds.
(e). Four minutes 35 seconds.
(f) At this move at level four, CC plays B-K3. The P×P move took five minutes 46 seconds.
(g) Five minutes 20 seconds. At level 8 CC-10 plays Q-Q3.
(h) Five minutes 4 seconds.
(i) At this position there is a forced mate; 12. B×Pch, K-K2 (if K-B3 then Q-B3 mate); 13. R×Nch N-K4; 14. R×N ch K-B3; 15. R-K6ch K-B4; 16. P-KN4 mate.
(j) Four minutes 50 seconds. The Challenger gets his second Queen but all is already lost.

Will there be master-level play at the 10th ACM Computer Chess Championship? Come to the Detroit Plaza, Detroit, Oct 28-30 and See!

Second Annual Penrod Tournament

. . . Don Gerue reports on the status of current entries listed in the upcoming September Second Annual Penrod Memorial Microchess Tournament. "In stand alone devices," writes Don, " we will have at least three in the 'over $150 category.' Those three are the new Level 10 Chess Challenger; the new Boris-Sargon unit; and the old Level 10 Challenger (which is being entered for comparison). In the under-$150 category we have Boris 'Diplomat,' the new Level 7 Chess Challenger, and JS&A's Chess Unit. Programs for Personal Home Computers (there are currently more than 10,000 of this type in use in homes as of this writing) include Sargon II.V and Microchess 2.0. Other possibilities for the tournament include Atari's chess unit, Boris 'Grandmaster' and an entrant from Software Specialists.

"The big news, which should be known by this time, is the joining of forces of Boris and Sargon. In more precise terms, Chafitz, Inc., has added Kathe and Don Spracklen to its technical staff. Result of this arrangement will be new upgraded units of Boris-Sargon. Sargon II, one must remember, was a surprise third-place winner at the 9th ACM Computer Chess Tournament in Washington last year. The Boris-Sargon II Chess Computers should be in full-scale production for the upcoming Christmas season.

"Both Dan and Kathe Spracklen have been, in my opinion, the two most important contributors to the improvement of microcomputer chess since the date of the introduction of the first Chess Challenger. With the Boris-Sargon unit destined, now, to lead the way, it seems that manufacturers of chess programs and chess devices will all be committed to dramatic improvements in their products. Buyers of such items will no longer be satisfied with devices or program that play mediocre chess.

"Some particulars of the Boris-Sargon unit include the new Sargon II.V program that is being used. The unit is also designed to think on the opponent's time. There will also be a 'force-the-move' key which, when hit, will make the unit execute its best move without further search. This is a neat feature for impatient players who can't wait while computers think. The Boris-Sargon device will also allow the opponent to take back a move if he wishes. In fact, the board can be set back as much as three moves to an earlier position if desired. This feature should prove to be a real teaching tool for those trying to improve their game.

"The program will be installed in a ROM cartridge with provision made for future additional RAM within the cartridge if needed. The consequences of this hardware design are dramatic. First, it means that future chess-program updates will be installed by the user at relatively low cost, and will stave off obsolescence. Secondly, programs other than chess can be made available for use with the same hardware. Mentioned so far are checkers and backgammon. Others are being contemplated.

"More information on the Boris-Sargon unit will appear next month."

New Worlds to Conquer

. . . Stand-alone chess devices have been known by various names since their emergence in the Consumer Electronics Market. They have been called "microchess games," "dedicated processors," and "chess computers" among other names. Most popular seems to be "microchess games" (as differentiated from chess programs on cassette or disk). These microchess devices have now entered a new phase of product improvement designed to make them more of a challenge at the chessboard.

Early last month the Chafitz company of Rockville, MD held a news conference in Chicago at the opening of the Consumer Electronic Show there. At that time the company announced "a

major and significant breakthrough in the field of Artificial Intelligence (A.I.) A.I., an offshoot of computer science, is concerned with producing machine behaviour which, if it came from a human, would be considered intelligent. Our researchers have developed a chess-playing program that is destined, in the near future; when it is combined with the breakthrough in A.I., to lead to the development of a non-human chess champion approaching the caliber of a Fischer or a Karpov. This milestone achievement marks the threshold of a new era in man's relation to computers."

Not to be outdone by Chafitz, Fidelity Electronics, formerly of Chicago but now in Florida, was also scheduled to reveal at the same Consumer Electronics Show its own, upgraded version of Chess Challenger. Fidelity's new product is claimed to have many new exciting features, in addition to its increased playing strength. As one example, after a player enters his moves into the Challenger keyboard, the Challenger makes its response in a loud, clear, electronic voice. This single feature, says the company, will make the device especially attractive to blind people. They will now be able to play chess against the machine without the assistance of a friend and improve their game. More information on the new products of both companies will appear in next month's issue.

KAISSA Getting Stronger?

. . . In a recent letter from Micha Donskoy from Russia, he reveals that in testing a chess problem with KAISSA, the program twice reached a maximum depth of 30 plies! This appears to be the deepest search yet reported by anyone. The Russian program begins to look more menacing on the friendly international scene. This search, notes Donskoy, was done within normal time limits (about five minutes CPU time on the IBM 370/168). In his note he also recalls the incident of the early Moscow-Stanford match. "When these four games were being played," he writes, "I was a student and took no part in working on what was then called the ITEP chess program — which turned out to be the predecessor of KAISSA. A.V. Uskov had been an active member of the team then and still devotes some time, now, on KAISSA. The Stanford-Moscow moves had been exchanged by wireless once a week. Strange to say, there were no errors in communication — such as those that unfortunately occur on occasion these days. The ITEP program played two of the four games using 3-ply search and the other two with 5-ply search. The two 3-ply-search games were drawn; the 5-ply-search games were won by ITEP. At that time, ITEP took about 10 minutes to carry out its 3-ply search and about two hours for the 5-ply. There was no direct computer-to-computer link-up; moves were sent from human to human who then coded the information into the computer terminal. It was an interesting experiment both in the field of computer chess play and in the field of international cooperation."

Selections for 10th ACM Tourney

. . . Entrants for the Detroit tournament will be selected by the committee of M.Newborn, B. Mittman and D. Levy. The 12 programs that will be accepted will be, in the opinion of the committee, the strongest active programs in the field. Three others will be placed on "standby status." The standbys, also, will be chosen on the level of their playing strengths. Entries to AMC's 10th tournament can be sent to Prof. Monroe Newborn, School of Computer Science, McGill University, Montreal, Quebec H3A 2K6, Canada. September 15 is the deadline for submitting entries. Programs which have not previously participated in ACM tournaments must submit at least two sample games. Move-timing information as well as level of the opposition should be indicated.

The London game

. . . The second London microprocessor chess tournament will be held in the West Centre Hotel, Lilee Road, Fulham, London, England, from November 1st-3rd, 1979. Individuals or companies desiring further details should write to David Levy, c/o PERSONAL COMPUTER WORLD, 62a Westbourne Grove, London, W2. This year's event is the first European Open Microprocessor Championship which is expected to continue on an annual basis. The highest-placed participants will automatically qualify for places in the final of the first World Micro Champion ship, presently planned to be held in 1980, also in London. In the first London tournament held last year, BORIS and MIKE tied for first place, with CHESS CHALLENGER in third place. BORIS and MIKE then staged a play-off game for the title which MIKE won. MIKE went on to participate in the 9th ACM Computer Chess Tournament in Washington where, competing against SARGON plus 10 large computer programs, it managed to finish in a tie for 8th place with BLACK KNIGHT.

"La Belle Mode"

...Ken Thompson, of Bell Labs, whose Belle program holds the current North American Computer Chess Championship Title recently sent a letter clarifying his views of computer chess: "As I said at the ACM Chess Tournament, the winning approach to computer chess has been clearly demonstrated in the last five years. Basically and bluntly it is horsepower. As in other examples of specialized computing, one approach is specialized hardware. Two years ago we built a small (25 chip) chess peripheral and took it to the World Computer Chess Championships in Toronto (where we tied for 4th and 5th positions with CHAOS). We learned from the experience and during the last year we designed and built a larger version (300 chips). The hardware relieves the computer of maintaining the chess board. In fact, except in the printing of chess moves, the computer we use does not know what game it is playing — it could be chess, checkers, backgammon or tic-tac-toe. The computer simply decides which side is to move and instructs the hardware to make a move for that side. At some point the computer asks the hardware to evaluate the current position and then uses this value in the normal alpha-beta algorithm. The current version of the hardware is not very 'tight' in either scale of integration, algorithm or technology. I believe that an easy factor of 5-10 could be obtained in the next iteration. Perhaps with effort a factor of 50-100 could be achieved. There is an empirical formula of USCF chess rating that I have mentioned before: $USCF=400N^{1/6}$

where N is the number of nodes evaluated in a play. Currently Chess 4.7 and Belle are comparable with N being about equal at 500,000. This gives a USCF rating (from the formula) of about 2,000. If specialized hardware could increase N by a factor of 100 (that would be 9-ply exhaustive searches) then the empirical formula would yield a USCF rating of 3600! This is clearly absurd, but the prospect of a 9-ply search is certainly exciting!"

Rating formulae

. . . Dave Cahlander of Control Data has used Ken Thompson's basic rating formula to project a table of USCF ratings based on node count and depth searches. Ken Thompson's basic formula is:

$$\text{USCF (rating)} = 400\ N^{1/8}$$

(where N = total number of nodes examined).

Dave expands this formula to:

$$N = 2m^{d/2}$$

(where m = total number of legal movs and d = depth in plies).

Combining the two formulas:

$$\text{USCF (rating)} = 400(2)^{1/8} \cdot M^{d/16}$$

Dave then derives a table based on this formula and it appeared in the Feb. ICCA newsletter:

USCF Rating	Node Count	Depth Searched (plies)
1000	1500	3.9
1200	6600	4.8
1400	23000	5.5
1600	65K	6.1
1800	168K	6.7
2000	390K	7.16
2200	840K	7.61
2400	1.7M	8.0
2600	3.2M	8.4
2800	5.8M	8.7

The table shows, dramatically, the explosive increase in tree searching plies and node count as chess ratings creep up at increments of 200.

Romania vs Netherlands

. . . Barend Swets of the Netherlands, who wrote the BS '66'76 chess program, is about to engage in a computer-chess match between his program and the Romanian program ASTRO-64. Ulrich Friedberg, of Romania, who documented the recently concluded game of the Romanian program against readers of a Bucharest newspaper, will be the Romanian intermediary between ASTRO 64 and BS '66'76 to be played over Telex lines. Some of the problems that will be met during the playing of the game is revealed in a recent letter from Swets to Valureanu. "I like the idea of a friendly match between ASTRO-64 and BS '66'76," wrote Dr. Swets. "The month of May is a convenient time, but an evening (or even a night) would be preferable to an afternoon. To avoid misunderstanding during the Telex game about notation, we should discuss preliminary arrangements. I enclose a copy of the Romanian notation as I understand it and the Dutch notation. They were taken from a booklet by Christian M. Biji, which describes all the European Chess Notations. I think that we should use both the Romanian and Dutch notations during the game. So, every move would be transmitted twice. I suggest not using English notation nor Telex notation. Perhaps the German would be preferable? Anyway, some redundancy should be built in. You mentioned in your letter to me that ASTRO-64 scored 2½ out of 10 against human chess players. Do you have an estimation of the program's playing strength in ELO points? The European computer chess tournament, earlier scheduled for the Netherlands, has been cancelled. Instead, there will be a tournament in London, September 25-28, 1979 during the EURO-IFIP conference. The chess tournament has been organized by Peter Kent, Rutherford Lab., Chilton, Didcot, Oxfordshire, OX11 OQX-England." (Barend Swets has promised to send along a documentation of the Romanian-Netherlands match upon its completion.)

COMPUTER GAMES
OF OTHER SORTS

(Including Computer Checkers, Computer Go, Computer GOMOKU, Computer Word Scramble, Computer Poker, Prisoner's Dilemma, etc. Submissions of these and other "intelligent" games welcomed by this department. Address all correspondence to COMPUTER GAME DEPARTMENT, (Personal Computing.)

Computer Backgammon

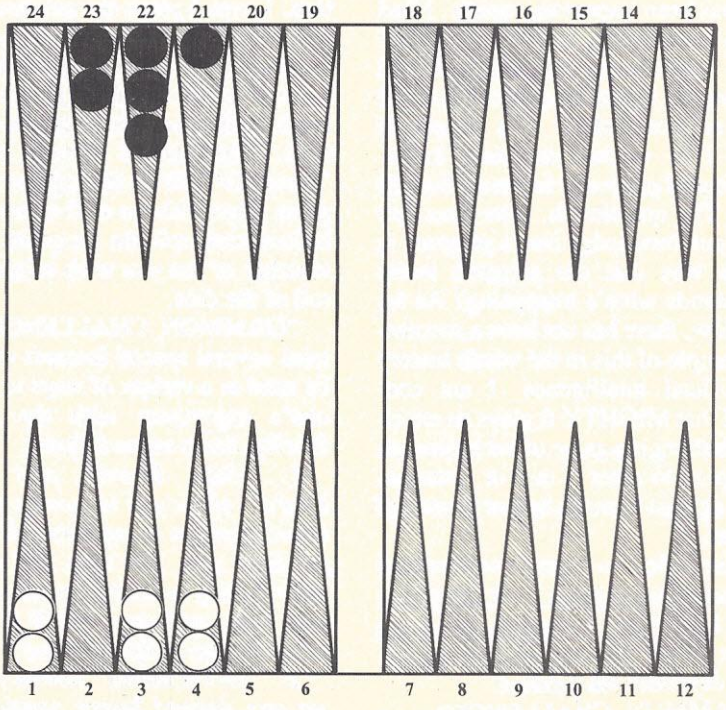
Backgammon is a game more closely associated with the Middle East and Far East than with other areas in the world. Its origins have been traced back 5,000 years to Iraq. It was always a game for nobility and was considered a favorite pastime for ancient emperors, pharoahs, sultans, maharajas, sheiks, caids, effendi and other members of royal families throughout the ages. Although a beginner with luck at dice might defeat a professional, it is an accepted fact that in a series of games, where the factor of luck has been equalized, the professional, because of his skill, could soundly trounce the beginner.

Computer-backgammon however, is a relatively new activity. Hans Berliner of Carnegie-Mellon's Computer Science Department has an intense interest in this field. In August of 1977, at an IJCAI conference at MIT, he described what was probably the first computer program to play a complete game of backgammon. "Because of the very high branching factors," wrote Dr. Berliner in his 1977 conference paper, "a backgammon program must rely on knowledge rather than on search for performance. Our program at Carnegie Mellon plays a generally competent game at an intermediate level of skill. It also correctly solves a high percentage of intermediate-level problems found in books.

"Backgammon is a game of skill and chance. It is an interesting object of study for AI because in any given position of which there are a staggering 10^{20} "(our galaxy contains a mere 10^{11} stars) "there are 21 possible combinations that the throw of two dice can produce. Each of these can be played legally in the average board position about 40 different ways (about 17 in actual game positions). Thus, if one were to investigate a backgammon position by tree searching it would be necessary to deal with a branching factor of more than 800 at every node! This is completely impractical. Therefore, backgammon must be approached with evaluation and knowledge in mind. Modern backgammon, furthermore, adds the additional problem of 'doubling.' This factor places an even greater emphasis on the use of knowledge, because it requires an **understanding** of a **position** (not just the ability to discriminate the best move) to know when to double and when to accept or refuse.

"The Carnegie Mellon program" (now called MIGHTY B) "plays a completely legal game of backgammon. The program considers hitting-relations between potential hitters and blots. It finds the optimal way to play every potential roll so as to hit the greatest number of blots. If only one blot can be hit, it calculates hitting the most advanced one. The program also finds effective blockading points which prevent opposing men from having access to those points. The program is capable of doubling and accepting or refusing doubles at all times. It will also resign positions in which there is no possibility of winning and will accept resignations when there is no possibility of winning a 'gammon'.

"To support decision making during the 'bearing off' phase, the Carnegie-Mellon program uses extensive tables. These tables give the probability for a given position of one side of bearing off all men in 1,2...,8 rolls and the expected number of rolls to bear all men off. The tables cover all situations for up to and including 8 men in the home board and up to and including 25 pips worth of men in the home board. The following example illustrates the type of thing the program does well. White is on the move and he has a 6,2 to play. The 6 must obviously be played from the 4 point. But what is the correct way to play the 2? Almost every human player would say 4-2. However, this is



not correct; 3-1 is better. The bear-off tables report the respective expected-number-of-rolls to be 2.748 and 2.739. Upon examination it turns out that all sequences of future rolls produce the same results in the two positions except when one of the next two rolls is 1,1. If this occurred, it would leave men on the 4 and 2 points with the preferred play, which allows 6 additional combinations of getting them both off on the next roll, over the other way of playing."

In a recent discussion with Dr. Berliner, the current state of the program was described by him as being amazingly outstanding. "MIGHTY B plays all phases of the game in a competent manner," he said. "And it is now able to perform a number of trick plays that one sees in books. It initiates these moves correctly and follows them up correctly.

"MIGHTY B doesn't do any searching. It **understands** situations and analyzes them. Then it reaches the right conclusion in a very high percentage of the time. I believe that this method of using a knowledge base is still fairly unknown.

"I discovered something interesting about 8 months ago while testing new routines in the program. Ever since I began using the new concept the program has been improving rapidly. I find it hard to put down, now, it is so addicting — and almost anything I do to it improves it. I have no doubt that it will be in a 'world class' in a couple of years. I've worked on these knowledge-based programs for more than 10 years. The question is, how does one really put knowledge into a program in such a way that the program really understands what's happening? As far as I know, there has not been a successful example of this in the whole history of artificial intelligence. I am convinced that MIGHTY B plays an excellent, challenging game of backgammon and I plan to enter it in 3 or 4 tournaments against humans before the end of the year."

Meanwhile, a new commercial backgammon-program, GAMMON CHALLENGER, has appeared on the market. Tom Throop, one of its authors, describes the product:

"GAMMON CHALLENGER is a backgammon product that operates on Radio Shack's TRS-80 computer, on both level 1 and level 2 machines," writes Tom. "The program which was developed by Ray Daly and myself, will run in 8K of memory.

"Ray is president of Computer Cablevision, which soon will be opening a retail computer store in Washington, D.C. He is also editor of 'Insiders: The TRS-80 Hardware Journal With Machine Software' and has written a variety of computer programs for the TRS-80.

"I am the author of the monthly column on 'Computer Bridge' in P.C. For several years I have been applying artificial intelligence strategies to various games, including bridge and backgammon. I hold the rank of Life Master with the American Contract Bridge League.

"The initial product, GAMMON CHALLLENGER 1.0, has performed very well in the games it has played against Tryom's 'GAMMONMASTER ' which is considered by many to be the leading dedicated backgammon product for the home consumer. In the games played thus far GAMMON CHALLENGER has played even with GAMMONMASTER.

"GAMMON CHALLENGER has three levels of play and a special option. Level 3 plays the quickest, but is less skillful than other levels. Level 2 is a compromise between speed and skill. Level 1 is the strongest player and the most challenging, but requires the most time. The special option is called "Level O". With this option the program plays with the skill of level 1, but before each roll the program inquires whether or not you wish to specify the roll of the dice.

"GAMMON CHALLENGER contains several special features which can be used in a variety of ways to increase one's enjoyment with the product. Briefly, these are as follows:

1. "Save Board" and "Recall Board" allow you to store a complete board position in memory and recall it for later use. You may, for instance, after saving a board position, play it one way, and then recall it later in order to play a different way.

2. "Set Up Board" allows you to set up any desired board position. With this feature you can find GAMMON CHALLENGER's response in any position of interest to you.

3. "Switch Sides" permits you to reverse sides so that you may play the computer's men and have the computer play your's. When this feature is used with the "Computer's Turn" option, the GAMMON CHALLENGER can play a game against itself.

"Change Level" permits you to change the level of play during a game. You may, for instance, start a game at the most skillful level, level 1., and then change to the quicker play of level 3 after the opening.

"To give you an idea of GAMMON CHALLENGER'S performance, one game between GAMMON CHALLENGER and GAMMONMASTER is presented below. The points on the board are numbered from 1 to 24, running counter-clockwise. GAMMONMASTER (Black) is moving in the direction from 1 to 24, while GAMMON CHALLENGER (White) is moving in the direction from 24 to 1. The 'dice' were 'rolled' by the GAMMONMASTER random-move-generator. 'B' indicates entering from the bar. 'BO' indicates bearing off. GAMMON CHALLENGER won a double-value game or 'gammon' from GAMMONMASTER, having borne off all its men before GAMMONMASTER removes any.

"For those interested in obtaining this game, GAMMON CHALLENGER, is available on a TRS-80 tape casette for $14.95. It may be ordered from Computer Cablevision, 2617 42nd Street, N.W., Washington, DC 20007. The tape can be ordered for either Level 1 or Level 2 of the TRS-80."

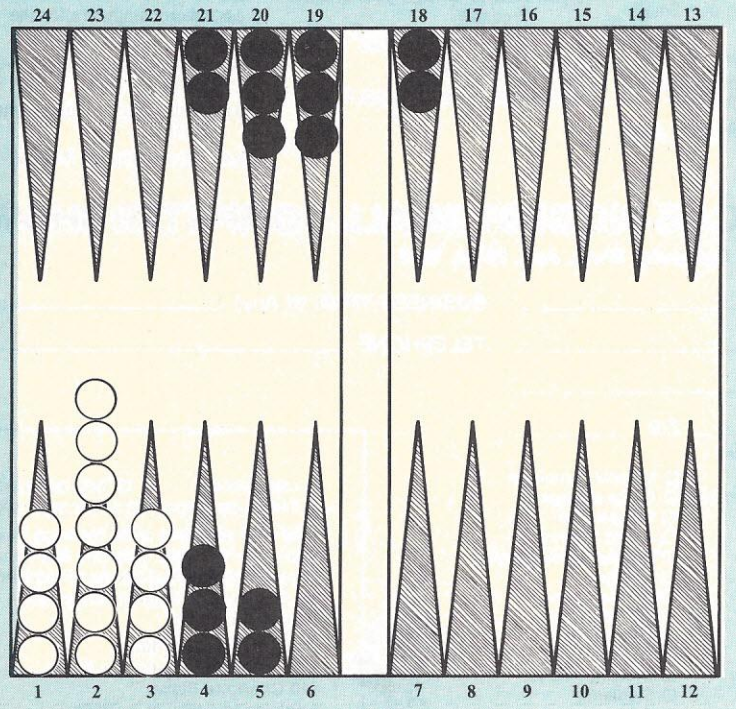
(Upcoming articles in this department will document further games of GAMMON CHALLENGER vs. GAMMONMASTER as well as games between computer and humans. Also upcoming will be latest news on MIGHTY B's campaigns against human players. Information on other computer programs, together with documented games and descriptions of programs, are solicited from readers. This material should be sent to "Computer Games Department", PERSONAL COMPUTING).

GAMMONMASTER (Black)	GAMMON CHALLENGER (White)
1. 1-7, 12-14	8-4, 4-1 H!
2. B-4, 4-10	13-9, 13-9 9-5, 9-5
3. 17-21, 19-21	6-4, 6-4 5-3, 5-3
4. 14-20, 19-20	8-7 H! 6-1
5. B-5, 5-8 H!	B-23, 13-8 H!
6. Blocked	13-10 H! 10-8
7. B-2, Blocked	7-2H!13-11
8. Blocked	4-2, 4-3
9. B-4, Blocked	8-4H! 4-2
10. B-4, Blocked	8-2, 11-6
11. B-5, 17-23 H!	B-22, 22-18
12. 12-14, 17-22	24-22 H! 24-23 H!
13. B-4, Blocked	23-18, 22-18
14. Blocked	18-15, 18-15 18-15, 6-3
15. B-5, 14-20	15-13, 13-8
16. 12-17, 12-18	15-12 H! 8-2
17. Blocked	12-7, 7-2
18. Blocked	6-1, 6-1
19. B-4, 17-18	15-10, 10-8
20. 4-8, 4-9 (Diagram)	8-6, 6-2
21. 4-9, 5-11	3-BO, 3-BO
22. 5-11, 19-20	3-BO, 3-BO
23. 9-13, 18-19	2-BO, 2-BO
24. 11-12, 11-12	2-BO, 2-BO
12-13, 12-13	2-BO, 2-BO
25. 8-14, 9-12	2-BO, 1-BO
26. 12-13, 14-16	1-BO, 1-BO

Symbols:
H! = Hit
B = Moves off Bar
BO = Bears off man
1-BO (Wins a gammon)

Black-GAMMONMASTER White-GAMMON CHALLENGER

White on the move with a 6 and 2.



Position at 20th move with Black to play. Black desperately tries to reach his home board and bear off a piece to prevent a gammon.

THE SEARCH FOR A SMALL COMPUTER SYSTEM STARTS HERE

It's the 3rd Annual National Small Computer Show

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presenting the state-of-the-art showcase for micro-and mini-systems technology and software. Here you can survey virtually all makes and models of small computers, whether your interest runs to a no-nonsense micro priced in the hundreds of dollars or a powerful mini costing $20,000 or more. They're all here.

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LECTURES: (Program subject to change)

Thursday, August 23

- **1 p.m.** The Peril of Becoming a Machine-Oriented Business User
- **1 p.m.** Introduction to Small Business Systems
- **2 p.m.** Selecting a Word Processing System
- **2 p.m.** Distributed Data Processing
- **3 p.m.** Accounts Receivable/General Ledger/Accounts Payable
- **3 p.m.** Is There a Computer in Your Educational Future
- **4 p.m.** Mailing Lists: Load, Time and Cost
- **4 p.m.** Word Processing Systems in the Law Office
- **5 p.m.** Basic BASIC
- **5 p.m.** Achieving Quality Control in Word Processing

Friday, August 24

- **1 p.m.** The Peril of Becoming a Machine-Oriented Business User
- **1 p.m.** Introduction to Small Business Users
- **2 p.m.** Selecting a Word Processing System
- **2 p.m.** Distributed Data Processing
- **3 p.m.** Unassigned at press time
- **3 p.m.** How to Write a User-Oriented Program
- **4 p.m.** Efficient Expansion of a Small System
- **4 p.m.** Investment Analysis
- **5 p.m.** Accounts Receivable/General Ledger/Accounts Payable
- **5 p.m.** Exploiting the Apple/Dow Jones Computer Link

Saturday, August 25

- **11 a.m.** Introduction to Personal Computing
- **11 a.m.** Unassigned at press time
- **12 p.m.** Computer Music Update
- **12 p.m.** Unassigned at press time
- **1 p.m.** Introduction to PASCAL
- **1 p.m.** Computer Art Forms
- **2 p.m.** Household Applications
- **2 p.m.** Artificial Intelligence
- **3 p.m.** How to Write a User-Oriented Program
- **3 p.m.** Investment Analysis
- **4 p.m.** Basic BASIC
- **4 p.m.** Unassigned at press time

Sunday, August 26

- **11 a.m.** Introduction to Personal Computing
- **11 a.m.** Computer Music Update
- **12 p.m.** Household Applications
- **12 p.m.** Unassigned at press time
- **1 p.m.** Efficient Expansion of a Small System
- **1 p.m.** Computer Art Forms
- **2 p.m.** Unassigned at press time
- **2 p.m.** Unassigned at press time
- **3 p.m.** Microcomputers for the Handicapped: Update
- **3 p.m.** Exploiting the Apple/Dow Jones Computer Link
- **4 p.m.** Mailing Lists: Load, Time and Cost
- **4 p.m.** Introduction to PASCAL

REGISTRATION FOR AMERICA'S BIGGEST SMALL COMPUTER SHOW

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- ☐ Educational
- ☐ Government
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- ☐ Industrial/Manufacturing
- ☐ Military
- ☐ Professional
- ☐ Stock Brokerage
- ☐ Transportation
- ☐ Utility
- ☐ Wholesale/Retail
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(Check main job function)

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- ☐ Architect/Builder
- ☐ Art Director
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- ☐ Computer technician
- ☐ Consultant
- ☐ Controller
- ☐ Engineer
- ☐ Industrial Designer
- ☐ Lawyer/law office mgr.
- ☐ Marketing manager
- ☐ Medical doctor
- ☐ Medical technician
- ☐ Office manager
- ☐ Programmer
- ☐ Public Servant
- ☐ Research/Development
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- ☐ DP manager
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National Small Computer Show,
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CIRCLE 23

More Hands From Duisman Program

BY THOMAS A. THROOP

As mentioned in last month's column, versions of George Duisman's bridge playing program for the PET, the TRS-80, and the APPLE all differ with respect to generation of deals and the play of cards. Specifying a certain deal of a given set on one computer will yield different deals on the other two computers. Another difference should also be noted. Cards specified by a human player using a TRS-80 or APPLE, to match a deal generated on the PET will not assure that the program will defend in the same manner as on the PET. In later versions of his program, perhaps George will consider modifying his three versions so that they will be compatible.

Those readers who have a TRS-80 or APPLE computer might be kind enough to write in and let us know how the Duisman program played any of the deals I have discussed (after you input the cards which were dealt by the PET). The following analysis concerns deal #32 of set 3.65 as dealt by the PET. Before reading further, those of you with PETs should ask your computer to generate this particular deal as shown. Then play the deal at the designated contract of 3 no-trump.

For TRS-80 or APPLE owners, the complete deal is as follows:

NORTH
(Dummy)
♠ J76
♥ AK85
♦ Q104
♣ 1032

COMPUTER WEST
♠ 8532
♥ J1063
♦ 52
♣ 874

COMPUTER EAST
♠ KQ
♥ 9742
♦ K8763
♣ KJ

SOUTH
(You)
♠ A1094
♥ Q
♦ AJ9
♣ AQ965

		Computer West	North (Dummy)	Computer East	South (You)
Trick	1	JH	5H	2H	**QH**
	2	4C	2C	**JC**	9C
	3	10H?	**KH**	9H	4S
	4	7C	3C	KC	**AC**
	5	8C	**10C**	3D	5C
	6	2D	**QD**	6D	JD
	7	3H	**AH**	4H	9S
	8	6C	**8H**	7H	10S
	9	5D	**10D**	7D	9D
	10	2S	4D	8D	**AD**
	11	3S	6S	KD	**QC**
	12	5S	7S	QS	**6C**
	13	8S	JS	KS	**AS**

Against 3 no-trump, Computer West led the jack of hearts. Dummy played low, Computer East threw the deuce, and I won with my queen. I decided to attack the club suit. If the E-W clubs were divided 3-2 with the king or jack sitting as a doubleton, then I might score four club tricks. Furthermore, if such indeed was the case and if I could further guess where the doubeton lay, then in addition to winning four clubs, I would be able to enter Dummy with its 10 of clubs to take a diamond finesse. In the actual deal, of course, any reasonable play of the club suit does yield this result, because the king-jack is a doubleton.

Deciding to play for the doubleton king capture, I led the 9 of clubs, at trick 2, from my hand. West dropped the 4, the deuce came from Dummy, and East won with the jack. East continued with the 9 of hearts, I discarded the 4 of spades, and West made the bad play of the 10 of hearts. This promoted Dummy's 8 of hearts to a winner.

Dummy's king of hearts caught West's 10, then continued with the club deuce. East had to give up his king which I won with the ace. Then, I again entered Dummy with the 10 of clubs to lead the diamond queen for a finesse. East did not cover, and I carefully unblocked the suit by playing my jack. If the queen had lost to the king, I would then need a diamond lower than the 10 in order to re-enter the Dummy and cash the good hearts.

When the diamond queen held the trick, it was then imperative to cash North's ace and 8 of hearts before repeating the diamond finesse, as there were no further entries to the Dummy. At trick 7, then, I cashed Dummy's ace of hearts, followed by the 8 — discarding the 9 and 10 of spades from my hand. Repeating the diamond finesse, I lead the 10 from Dummy, East again playing low. The last four tricks fell to my ace of diamonds, queen and six of clubs, and ace of spades. I wound up making six, having lost only one club trick to the computer.

The accompanying tableau shows the play described, trick by trick.

Deal #37 of the Duisman program was played at 4 spades and went down one on a bad trump break; losing a heart, two diamonds, and a trump. The Duisman program allowed me to ruff two diamonds in Dummy; otherwise I would have gone down at least one more trick. Deal #39 is uneventful, as 4 spades is easily made. On deal #40, I played 3 no-trump, making 4. With the opening lead of the 3 of hearts, you must be very careful. You may play low from Dummy, in which case the

defense cannot take more than four heart tricks with any distribution of their hearts. Or, if you play the king of hearts from Dummy, losing to East's ace in this case, you must not cover the return of the 9 of hearts, but simply play low. On deal #41, I played and made 3 hearts, after some errors by the Duisman program.

Another bidding program that has come to my attention is one written by Tony Wasserman of California. The program is quite extensive and apparently is capable of bidding according to four different systems: Goren, Kaplan-Sheinwold, Schenken and "Standard American." One example of the program's bidding was reported in the *Introduction to Artificial Intelligence* by Philip C. Jackson, Jr. He presents the following deal and bidding sequence as executed by the Wasserman program:

NORTH
♠ A Q 6 4
♥ 10 9 6
♦ 5 3
♣ Q 7 6 5

WEST
♠ J 9 7
♥ A Q 8 5 2
♦ 10 6 2
♣ A 8

EAST
♠ 3
♥ 3
♦ A K Q J 8 7 4
♣ J 10 9 3

SOUTH
♠ K 10 8 5 2
♥ K J 7 4
♦ 9
♣ K 4 2

South	West	North	East
	Pass	Pass	1D
Double	Redouble	1S	2D
2S	3H	Pass	4D
Pass	5D	Double	Pass
Pass	Pass		

The computer generated the bid for all hands in this demonstration. The final contract of 5 diamonds reached by East-West is quite reasonable. In fact, with proper play, 5 diamonds can be made against any defense. South is a bit weak for his takeout double by most people's standards. This questionable bid may have influenced the computer when, acting as North, it doubled the final contract.

As mentioned before, I appreciate hearing from many of you who have been sending along your comments and questions on computer bridge. I should like to pass along some recent comments received:

Jim Hilger of 5315 17th Ave., Moline, Illinois 61265, writes: "I would like first to tell you how much I enjoy your 'Computer Bridge' series in *Personal Computing*. I have been developing some contract bridge programs of my own, and have found each crumb of knowledge from the 'outside world' extremely helpful. Secondly, I thought perhaps you would like to have your ear bent concerning my own bridge programs, which are alive and running well in Moline, Illinois." Jim's letter describes his BID and PLAY programs which operate on the APPLE II computer with 32K and floppy disk. The programs in combination will bid and play deals generated by the computer. Initially, the user is shown South's hand, which he will bid while the computer is bidding the North, East and West hands. If North or South becomes declarer, then the user may play the deal against the computer (apparently the PLAY program only knows defense.)

Those of you with an APPLE II system might like to contact Jim directly to see if his programs might be available to you and if they will run on your particular system. I have written to him for further information on the programs with perhaps, some illustrative details. Hopefully, I will be discussing the Hilger programs in a future column.

Colonel Harold Kinne of 2514 Custer Parkway, Richardson, Texas 75080, writes: " I have a bridge program on my Polymorphic 8813 which identifies the correct opening bid for any hand using basically Goren principles with the 5-card major requirement. It takes 70 sectors of the 350 on a 5-1/4-inch floppy, is about 18K and written in BASIC." The Colonel goes on to describe the procedure for entering a given hand. The procedure involves answering a series of questions concerning the suits in which there are aces, kings, queens or jacks. With this information in memory and knowing the distribution by suit, the program then generates a recommended opening bid. Those of you with a Polymorphic 8813 computer may wish to write to Colonel Kinne.

Another letter is from Victor Kay, #64, 3650 Los Feliz Blvd., Los Angeles, California 90027. He says "Many more people are interested in bridge than in chess so I don't understand why it is taking so long to produce programs since it is generally conceded that bridge programming is more straightforward." I am curious to learn of Victor's source of information for his opinion. In my own opinion bridge programming is *not* more straightforward. All the chess programs that I know play chess by extensive tree-searching and subsequent evaluation of resulting positions under consideration. These programs do not attempt to "think" in selecting possible moves for consideration. A tedious evaluation of the many positions emerging from the many plies of the program and from available search time leads to the choice of move. On the other hand, my own bridge playing program, at least, "thinks" the way a good player would think at the table. Specifically, it considers appropriate strategy and tactics for playing a given hand. Furthermore, the fact that there are far fewer bridge programs than chess programs suggests that bridge programming is indeed *less* straightforward than chess.

(Your comments on Computer Bridge are welcome. Address correspondence to Computer Bridge Department, *PERSONAL COMPUTING*, 1050 Commonwealth Ave., Boston, MA 02215.)

An example of PET commands available for the 8K Duisman Bridge Playing program indicates its latitude.
Computer asks; WHAT CONTRACT?
You enter:
A. SKIP (Skip to another deal in set)
B. PASS (Skip to next deal in set)
C. CONTRACT (Declare a contract and start play)

Computer asks: WANT TO PLAY THIS HAND AGAIN?
You enter:
A. YES (Play this hand again)
B. NO (Move to next deal)
C. LOAD (Load a deal from cassette tape)

The Wonderful Future of the Microcomputer

Artificial Intelligence: An MIT Perspective, Vol. 1 of a 2-volume series; edited by Patrick Henry Winston and Richard Henry Brown; © 1979. The MIT Press, 28 Carleton St., Cambridge, MA 02142; 490 pp.; $25.

If the human mind could look as far forward as it does backward then there would be no horizons. Because we are unable to do that, we must content ourselves with the diversion of examining the present to envision the future. An opportunity to do that, in the field of microcomputing, has presented itself with the publishing of a new book from MIT called *Artificial Intelligence: An MIT Perspective*.

In the foreword to the book, Patrick Henry Winston and Mike Brady, coeditors of the series, have inserted this thought:

"Artificial Intelligence offers a new perspective and a new methodology. Its central goal is to make computers intelligent; both to make them more useful and to understand the principles that make intelligence possible. That intelligent computers will be extremely useful is obvious. The more profound point is that artificial intelligence aims to understand intelligence using the ideas and methods of computation, thus offering a radically new and different basis for theory formation. Most of the people doing artificial intelligence believe that these theories will apply to any intelligent information processor, whether biological or solid state."

The material in the book presents a glimpse into the frontiers of research going on in AI labs all over the world. And the editors of this book have performed a commendable task in throwing open the doors of MIT's AI labs and letting the public in to have a look around.

One does not have to be clairvoyant to predict that what goes on now in the large computers will some day emerge on the screens of PETs, Apples, TRS-80s and a host of other microcomputers. The numbers of micros are increasing, memories are expanding, speeds are stepping up, prices are dropping and someday the paths of the microcomputers and the maxicomputers will come together at one vanishing point. A look, then, at some current AI research, through the medium of this book, reveals how greatly the microcomputer will mature from game-playing to complex-problem solving.

The TV technician of the future, for example, may someday carry a small "EL" computer in his pocket, next to his trusty VOM. With it he will be able to pinpoint the trouble in a TV set that has gone black. Showing him the way, most likely, will be a modified "EL" program by Richard Stallman and Gerald Sussman; a program that computes values in electric circuits.

A "Truth Maintenance System" is the objective research by Jon Doyle. Its basic purpose is general problem solving. However, its logic in dealing with true or false conditions might someday be the basis for the presence of a microcomputer in a policeman's travel kit. Questioning of a suspect, using Doyle's program modification, might lead either to a quick arrest or a justified release with apologies.

Johan de Kleer uses his NEWTON program to solve general problems in mechanics. "What," asks de Kleer, "should the initial height of a block be so that it can successfully complete a loop-the-loop on a curved track?" NEWTON solves that problem. In micro form, NEWTON might just as easily tell a ski jumper how much force to use in starting his run down the chute, taking into consideration weight of skier, wind, weather conditions, surface condition, friction-against-ice deterrent, etc.

Charles Rich and Howard Shrobe have a program called Programmer's Apprentice. Its function is to make a programmer's life easier by having the computer write its own program — or at least help the programmer write one.

Another program called PARSIFAL, using a language called PIDGIN (once known to every schoolboy) is Mitchell Marcus' concern. It helps the computer to analyze English grammar and interpret meanings.PARSIFAL's basic dedication is to teach the computer to understand when spoken to and to respond to human conversation. When the program is someday reduced to the micro stage, it will find a permanent place in the hands of a politician and by means of an ear plug will provide instant and proper answers to questions on a TV interview such as *Meet The Press*. There'll be no putting of feet into mouths with PARSIFAL by the politician's side.

NUDGE is a program under research by Ira P.Goldstein and Bruce Roberts. One can easily visualize this as becomign the first, true electronic secretary. The authors list an example of what NUDGE can do. NUDGE accepts informal requests and analyzes these requests to avoid possible conflicts. The program then resolves the conflicts, sparing everyone the prospect of potential grief. The authors offer an example of what the program can do.

"NUDGE", barks Mr. Boss, curtly. "Schedule a meeting with Bruce for next Tuesday! " Click, click, hang-up! The computer responds instantly by declaring: "I understand your request to mean 'Schedule one meeting with Bruce and me at 3 in the afternoon next Tuesday one week from tomorrow lasting one hour in my office to discuss the Personal Assistant Project!" NUDGE then goes into a search and resolve phase and comes up with the folowing announcement. "Boss! Your preferred time for meeting with Bruce on Tuesday is already filled with a meeting with Mark. However, Mark's purpose is to discuss language research and Candy is available for that. Shall I reschedule Mark to see *her* instead?"

Another research subject is commodity trading in wheat. It is used by James L. Stansfield in his analysis program for information analysis. There is a need to help make decisions in complex situations that arise in economics, business, politics, the environment and strategic planning and researching.The logic in commodity trading should

show the way to solutions in other fields. The risks involved in this real-life game situation by Stansfield portray a farmer caught in a dilemma. When his storage bins are filled with grain he must decide, at a critical moment in his calendar, how much to plant and how much to store. He can then sell off part of his crop on the futures market if he feels it offers a good price. There are enough variables in this market maneuver to either drive the farmer to the brink of disaster or assure him of a good profit. Stansfield's program, ANALYST, sets up methods that would enable a farmer to compute a proper course of action in this activity. When ANALYST is reduced to micro size it surely will be found in the planning room of every farmhouse in the country.

Among the wealth of other research is the work of Professor Marvin Minsky who is involved in what he terms "The Society Theory of Thinking." As an illustration, Minsky presents the following premise: "Imagine a child playing with blocks. Think of the child's mind as a society of interacting agents. The child's principal goal — at a certain moment — might emerge from an active WRECKER. (WRECKER wants to push over a tower of blocks — to hear it crash). WRECKER devises a plan — to accomplish its objective — that requires another agent, BUILDER. (BUILDER is only interested in constructing a nice tower)." Professor Minsky then goes on to show how conflicts emerge between BUILDER and WRECKER. The innocent agent, "PLAY-WITH-BLOCKS," becomes involved, also, in that dispute. Meanwhile the latter agent is already engaged in a dispute with a higher-level agent PLAY who, in turn, is in conflict with I'M GETTING HUNGRY! In the end, Professor Minsky predicts that WRECKER will win a small victory as the child smashes the tower it has built then stomps out of the room to grab a snack.

The foreword of the book can well function as an epilogue. "There are side effects of artificial intelligence that deserve attention, too," say Winston and Brown. "Any program that will successfully model even a small part of intelligence will be inherently massive and complex. Consequently, artificial intelligence continually confronts the limits of computer science technology. The problems encountered have been hard enough and interesting enough to seduce artificial intelligence people into working on them with enthusiasm. It is natural, then, that there has been in the past, a steady flow of ideas from artificial intelligence to computer science. And the flow shows no sign of abating."

After digesting all the morsels of research served up by this first volume, the reader's appetite for the forthcoming second volume should increase greatly. Reading Volume I causes one to wonder about the forthcoming Volume II. One can only conclude that the microcomputer is destined to become a marvelous creature some day. And, perhaps, it could become man's best friend — replacing the dog.

— Reviewed by Harry Shershow

All Meat and No Potatoes

Chess Skill In Man and Machine, edited by Peter W. Frey; Springer-Verlag New York, Inc., 44 Hartz Way, Secausas, NJ 07094; $14.80; 225 pp.

This book is a record of some of the deliberations of a graduate seminar held in 1974 at Northwestern University on material represented by the title. In addition to the almost obligatory history of computer chess tournaments, the book includes texts and monographs in computer science by various researchers in the field. Northwestern's CHESS 4.5 (and 4.6) programs are reviewed as an example of progress. The editors also discuss various problems in programming, and manage to include an interesting selection of computer-chess games.

Unlike other books dealing with technical problems, this one is written in an amusing, non-didactic, informative vein. For instance, the book reveals that attendance at a computer chess tournament can be fun, with the solemn funereal hush so pervasive at a human chess tournament being entirely absent. Without causing any fluctuations in the computers' clocking sequences, the spectators are very vocal. They second-guess board moves, laugh, talk, and even break into applause and heckling while the computers go imperturbably about their business of thinking their mysterious thinks.

When chess playing programs first appeared some enthusiastic programmers predicted that shortly the new world champion would be non-human. This optimistic forecast has not come to pass as yet; and may not for a very long time, if ever. As in so many other machine applications the complexity of human performance of a task involving thought processes has been vastly underestimated.

The book points out that programming a computer to play an adequate game of chess is complex because human thought itself is complex. We overlook the amount of self-programming we have done in learning to play chess, or performing any other activity. Once learned, we do things by rote and forget how laboriously we worked to acquire the skills involved.

A major problem in programming is the one involving a selective research. Edgar Allen Poe in "The Murders In The Rue Morgue" said it is the more alert rather than the more concentrative chess player who wins, and this is as true with programs as it is with humans. Perception is the key. A master does not look at hundreds of continuations; he looks only at a few of the most promising. He has perfected the art of selectivity.

The future of programming lies in increasing a program's library of patterns, evaluations and playing methods. The program is then given the ability to modify these factors. An early assumption in computer chess was that to produce a master all we had to do was insert a plus or minus value based upon heuristics. We now know that that assumption was an oversimplification. To imitate human thought (which leads to improved programs) the program must be taught like a human and trained to act like one.

Peter Frey points out further that pattern recognition in computers is still primitive. We have barely progressed beyond Shannon's methods (1949). However, the larger and more modern computers now use a 64-bit word. One can say that whatever it is computers are doing wrong, they are now doing it at a faster rate than ever before.

Increased depth of search by "brute force"(greater speed with modern machines) will not help in improving

evaluation. The trouble with increased depth of search is the exponential explosion in tree search, which sets a limit on depth of plies used. (Thirty legal moves in a typical chess position produce about 900 possible positions after white and black have each moved once, about one million possible positions after two moves, and one billion after three moves.) The better approach, says Frey, is to increase the evaluative function.

The human's search is variable goal-directed, the program's is spread-eagled. In evaluating a terminal position (a static position), the human's analysis is based upon achievement of a goal. The program, on the other hand, uses polynomial equations, or counting up of pros and cons.

A program's lookahead is geared to a fixed number of plies. A human's is geared to variable depth of search. Therefore, to evaluate a static position the human approach, being more flexible, is more efficient.

Among some of the drawbacks to computer programming are that a full width search means the program will consider all possible first moves. A human, on the other hand, considers only a few, often only one. Thousands of irrelevant moves that the program might examine are refuted by the human as a futile, time-wasting analysis. Furthermore, ideas discovered in one branch of the search are not transferrable to other branches. Also, information acquired during earlier tree searching is not available later and the program, in a time-wasting maneuvre, must start again from scratch. Evidently, it has not been possible, yet, to teach the computer the importance of the passage of time.

A major programming problem for future solution is how to program recognition of the need for increasing depth of ply analysis. This must be done so a variable depth search can be achieved. Human deepening of analysis is related to changing goals which, for the present, is beyond a program's ability. Once a move has been eliminated from consideration by the program, it is gone for good, whereas a human will recall a move formerly eliminated and apply new factors.

Humans analyze in terms of large perceptual units or functions, says the book. Programs do not yet have this ability.

These drawbacks make long-range program planning extremely difficult. Yet, it is the combination of long-range planning plus the ability to recognize exceptions to general principles that make a master. Presently, such capability is beyond any computer program.

The human learns as he goes along. A program is stupid and will repeat the same error over and over, in an echo pattern, unless reprogrammed. A program that learns from its own mistakes has been devised to play checkers. But this method is not applicable to chess, which deals not with 30 component numbers but with 31,000,000.

The easiest thing to program is value of material. Therefore, computer programs, being quite materialistic, grab at "anything that isn't nailed down." The book concludes that when you play against a program, you should offer it gambits whose end results are beyond its horizon and will result in a weakened position

One question that is asked frequently is, why try to improve computer chess play and indulge in the "shimmering mirage of master-level play?" The reason, says Peter Frey, is that chess programming is valuable because it helps to understand human problem solving in all fields.

The March issue of *Personal Computing* carried a report of a program run on a microcomputer defeating a program run on a multi-million dollar mainframe. The programmer of the winning SARGON II exultantly claimed that the dominance of the giant computers in computer chess tournaments was over. While this was, perhaps, a bold claim, it is not entirely inconsistent with latest thinking. Peter Frey echoes the same attitude in his book when he says: "Lack of proper programming tools has plagued the whole field of computer chess. When these tools are found, the domination of computer-chess tournaments by old-fashioned programs like CHESS 4.5 will finally come to an end." This means that full-width search programs, no matter how expertly modified and using the latest computers will give way to better programmed units relying on selective variable depth searches.

Chess Skill in Man and Machine is an extremely meaty book with very few potatoes to dilute it. The book is a must for anyone who wants to know more about the problems and direction of future computer-chess programming.

—Reviewed by Morris Miller

PRODUCT CLOSE-UP

Texas Instruments Home Computer

BY RUSS WALTER

At last, Texas Instruments has revealed details about its new personal computer.

The TI-99 will come in several models. The first model that TI will ship is called the TI-99/4. It costs $1150 and includes a 16-bit CPU (the TI-9900), a 16K general-purpose RAM, a ¼K scratchpad RAM, a 26K ROM (of which 14K are for BASIC, 4.4K are for the monitor, and the remaining 7.6K are for a Graphics Language interpreter, an Equation Calculator and audio), a 41-key keyboard, a 13" CRT that displays 16 colors, and a 4-voice audio synthesizer (3 of the voices are musical and the remaining voice is for special sound effects). The CRT screen displays 24 lines of 32 characters. Each character is an 8-by-8 dot matrix; you can invent your own characters.

(A smaller model, the TI-99/3, will cost much less, mainly because it won't include the color CRT. The company hopes to attach the TI-99/3 to your own home color television set via an RF modulator, but is waiting for the FCC to approve the modulator.)

The company will begin shipping the TI-99/4 in "late summer". By autumn, you can buy the TI-99/4 at Computerland, other computer store chains, electronic stores, general department stores and Texas Instruments' own outlets. The computer comes with a 90-day warranty: if the computer breaks down during the 90 days, return it to your dealer and he'll immediately give you another computer.

After you spend the $1150 for the TI-99/4, you'll want to spend a few extra bucks for options. For programmers, the most popular options are tape recorders — the $1150 includes *interfaces* to two tape recorders, but not the tape recorders themselves. TI says you can buy the tape recorders from Radio Shack or anyone else, but doesn't hawk any particular brand.

Other options, for programmers with more money, are a 5¼" minifloppy disk drive, a 32-character thermal printer, an RS-232 interface and joysticks. TI will start selling them at the end of 1979, but hasn't yet decided on the prices.

The flashiest option is the speech synthesizer, which costs $150. The unit contains the same ROM chips as TI's Speak & Spell but uses a different vocabulary. It can pronounce about 250 words, 8 of which are "I", "am", "the", "home", "computer", "by", "Texas", "Instruments".

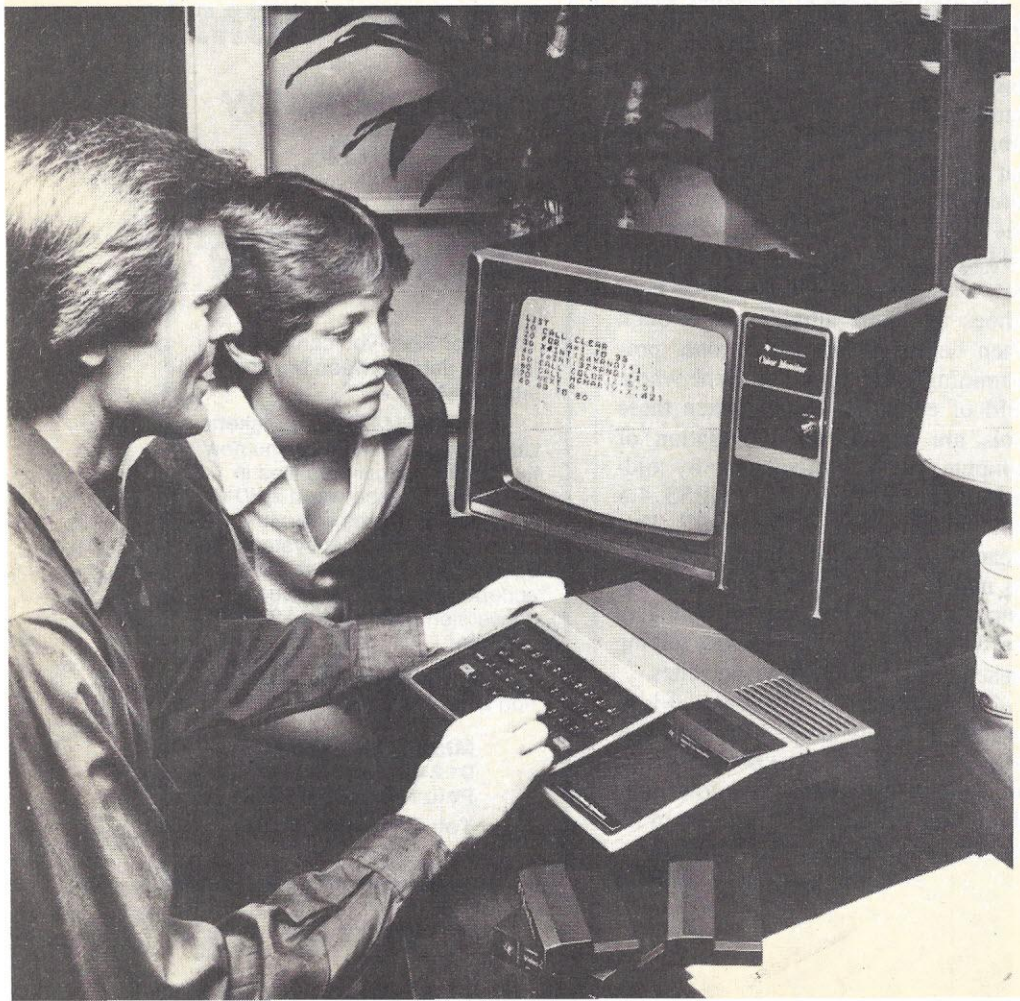
Like the Exidy Sorcerer and the TI Programmable 59 Calculator, the TI-99/4 accepts ROM packs. (A ROM pack is a cartridge that contains a ROM. You plug the cartridge into the computer.) Instead of saying "ROM pack", TI says "Solid State Software Command Module". Each ROM pack contains a single application program. By the end of 1979, TI will offer 17 ROM packs: Demonstration, Diagnostic, Early Learning Fun, Beginning Grammar, Number Magic, Video Graphs, Home Financial Decisions, Household Budget Management, Video Chess, Football, Physical Fitness, Speech Construction, Investment Analysis, Personal Record Keeping, Statistics, Early Reading, and Tax and Investment Record Keeping.

Some may be free; of the others, the cheapest costs $19.95; the most expensive costs $69.95. The largest holds 30K of ROM. Later, additional ROM packs will be developed by TI and Milton Bradley.

Books about the TI computer are being published by TI and McGraw-Hill. About a month after McGraw-Hill's book comes out, Hayden will publish a competing volume.

TI's BASIC has several peculiarities. Written by Microsoft, it is compatible

Russ Walter publishes The Secret Guide to Computers. *You can get the 6-volume 9th edition for $16.25 from Russ at 92 Saint Botolph St., Boston, MA 02116. A 10th edition, containing more info about TI and other vendors, is in progress.*



with Microsoft's BASIC on TI's larger computer (the TI-990, which sells for about $10,000). But it is quite different from Microsoft's other 5 famous BASICs (PET BASIC, Ohio Scientific BASIC, CP/M BASIC, Applesoft BASIC, and TRS-80 Level II BASIC.) You'll have a hard time converting programs from those "friendly 5" to TI.

BASIC is the only language available. TI does *not* plan to let you use machine language, assembly language or Pascal on the 99/4. To prevent you from sneaking into machine language, TI BASIC omits the words PEEK and POKE. Although TI BASIC lets you do some graphics (by saying CALL COLOR and CALL VCHAR and CALL HCHAR), it omits commands that would let you make full use of the Graphics Language interpreter. You can't duplicate the high-quality graphics that appear in the Video Graphics ROM pack. Although BASIC lets you access the speech synthesizer's list of 250 words (by saying CALL SOUND), you can't add your own words to the list, and you can't make the computer pronounce an isolated phoneme.

Because of these limitations, some programmers have criticised the 99/4 as being "merely a toy". On the other hand, TI argues that the average consumer does *not* want to do sophisticated programming, and would rather simply use the canned programs that TI and Milton Bradley provide.

Other criticisms of the TI computer are: its RAM is small (only 16¼K), the lines on the CRT are short (only 32 characters), the ROM packs are expensive, and the keyboard is limited (only 41 keys, and they don't allow lower case letters).

The version of BASIC, though unusual, is solid. It is accurate to 13 digits. A variable's name can contain 15 characters; all 15 are significant, and you don't have to worry about embedded keywords. If you make a mistake, the computer explains the error by using full English words, instead of abbreviations. The BASIC is fully compatible with ANSI Minimal BASIC, (most other microcomputer BASICs are not).

The 3 musical voices cover 5 octaves and 30 volume levels. You can make a note last anywhere from 1 to 4275 milliseconds.

When you turn on the computer, it gives you three choices: you can use BASIC, or a ROM pack, or the Equation Calculator. The Equation Calculator lets you type an equation, which the computer will solve. For example, if you give the computer an equation that involves multiplication, the computer will solve the equation by either multiplying or dividing.

The Video Chess ROM pack was developed with the help of International Chess Master David Levy. It handles human-against-human, human-against-computer, and computer-against-itself. It can play 3 skill levels, and you can choose the computer's playing style: normal, aggressive, passive or losing (if you need an ego boost). At the end, you can get an "instant replay" of the whole game.

TI's 99/4 is no "bargain". When you compare its features against those of the Bally, Atari, Apple, PET, Sorcerer, Compucolor, Ohio Scientific, and Radio Shack, you find that TI's price is neither remarkably high nor remarkably low: it is "reasonable". None of TI's features is breathtakingly new; each of its features can be found in some of those other computers, and sometimes in better form. TI's *combination* of features is attractive, but so are the combinations offered by its competitors.

If you're planning to buy a TI computer to "love for the rest of your life", you'd probably do better to wait for the 99/3 (which will be much cheaper) or the rumored 99/5 (which, if it indeed exists, will be much more powerful). But if you're in a rush to find out what the 99 series is like, your only choice at the moment is to get the 99/4.

TI says that though the 99/3 will be much cheaper than the 99/4, the 99/3 lacks the color monitor *and lacks several other features*. But TI won't say which features the 99/3 lacks.

TI is *not* aiming the 99/4 at programmers. Instead, TI's marketing emphasizes the pre-programmed ROM packs. Although the Sorcerer has ROM packs also, TI's ROM packs will be more numerous and contain applications programs, rather than languages and system utilities.

Like the Atari, the TI-99/4 is aimed mainly at *non*-programmers. That's why TI introduced the computer at the Consumer Electronics Show, rather than the National Computer Conference.

To contact TI, write to TI-99/4 Consumer Relations, Texas Instruments Inc., Box 53, Lubbock, TX 79408.

TI's Solid State Software

Texas Instruments will support their Model TI-99/4 home computer with plug-in Solid State Software command modules. Each module contains one program in ROM, ready to use as soon as it's plugged into the computer.

Initial offerings, which TI hopes to have available by year's end, fall into the categories of personal finance, home management, education and entertainment. Here's a run-down on some of these programs:

Household Budget Management — This program helps families implement a budget and monitor their expenses by category, month and year. It can help you foresee the effects of new purchases or of changes in income or expense. The program can also balance and reconcile outstanding checks. It can help project cash position at any point — expecially important when new purchases are being considered. Month-by-month expense records can be kept so that when income tax time comes around, you can call up the data to help prepare your return.

Home Financial Decisions — This program assists in making decisions about loans, housing, automobiles and savings. You can explore and analyze available alternatives. According to TI, the program helps answer questions like: Should I lease or buy a car? Is it more advantageous to buy a home or to rent? Should I keep my current house or buy a new one? Is one house a better investment than another? Should I pay off a certain loan early?

Beginning Grammar — This program helps school children (grade levels 3 to 5) learn the basic parts of speech and how the speech parts are used to build sentences, TI said. It combines sounds and color pictures to make the learning of grammar basics more game-like, enjoyable and rewarding. Children can work alone or in

groups. The computer guides students through the activities at their own pace, providing encouragement and rewards as progress is made.

Early Learning Fun — This "learn by doing" package combines shape, number and letter recognition activities with exercises in counting and sorting. Children match and identify shapes, and sort and count objects that appear on the screen. Detailed parents' screens are provided so the parent can read simple instructions to the child on how to perform each activity.

Number Magic — Designed for children ages five and up, this math-education program helps teach addition, subtraction, multiplication and division through a series of easy-to-follow, game-like activities. The computer gives the problems; the child gives the answers. Scores are kept automatically. Visual and audio rewards for good scores keep the child's interest, TI said, while selectable difficulty levels assure continued interest and skill development.

Physical Fitness — This program helps you develop a custom exercise plan based on age, weight and general health. Based on the exercises found in *The United States Book of Family Fitness* by the President's Council on Physical Fitness, the program contains five progressive exercise levels, with separate categories for men and women.

Video Chess — This program, developed with the help of International Grand Master David Levy, allows you to play chess against the computer or against a friend. Special chess problems can be set up for study purposes, or the computer can play both sides.

Football — This program is based on known football play probabilities derived from actual professional statistics. You coach and quarterback one team — call the plays, arrange the defense and offense — in a battle against an opponent or against the computer. A regulation-length game or a shorter one can be played. The computer offers representations of each play, and built-in scoreboard automatically keeps up with touchdowns, penalties, downs and quarters. Thirteen offensive and eight defensive plays provide options ranging from line plunges to sweeps, draws, screens and long bombs to the blitz, the punt return and the field goal.

Video Graphs — This program requires at least one handheld remote unit (up to four can be used). The remote functions like an "electronic paintbrush". You can create fine-line color drawings, design mosaic patterns, construct objects with special video building blocks, create charts and graphs and paint them with different colors, or design a kaleidoscope of repeating figures, patterns and designs. Even pictures with a 3-D perspective can be created. You supply a straight-line, one-dimensional drawing; the computer then plots the front and side views and projects the object in a three-dimensional image. The object or drawing can be rotated, magnified several times and re-designed. A cassette recorder can save your creations and retrieve them whenever you like.

Remote Control For the Home

BY RICK WHITESELL

Ohio Scientific's AC remote control system allows even inexperienced users to readily control lights and appliances with home computers. "Plug and go" modular components used with a special remote control BASIC allow you to get the AC-12 up and running minutes after removing it from the box.

The system alleviates the previously high cost of AC remote control (about $100 per remote control device). OSI's system — with BSR X 10 remote control command console, two lamp modules, two appliance modules and special 9-digit precision BASIC — goes for about $175.

To run the system, you need the 540 revision B video board. This board may be purchased installed in new Challenger C2-4P and Challenger C2-8P computer systems (available soon on the Challenger 1P). Both the 540 Rev B board and the 542 sound keyboard are also available for system upgrades. The video board provides sixteen colors (including black and white) with upper and lower case alphanumerics and predefined graphic characters in a 64-character by 32-line format. The 542 sound keyboard provides programmable sound generation via a programmable divider, a companding 8-bit digital-to-analog converter and joystick capabilities (twin joysticks should be available soon). But the color and sound options are all above and beyond the AC remote control system.

The actual remote control system uses a modified BSR X10 remote control system (not microprocessor based). The BSR command console provides manual remote control via a built-in keyboard.

Devices to be controlled plug into one of three basic types of remote control modules. The lamp modules come in two forms: a palm-size unit that plugs into any standard AC wall socket and a light switch module. The palm-size lamp modules handle up to 300 watts of incandescent lighting while the wall switch lamp modules handle up to 500 watts. Both lamp modules permit remote control dimmer operation as well as remote on/off commands. Though the appliance modules do not provide the dimmer feature, they can drive up to 500 watts of incandescent lighting, a 1/3 HP motor or a 15 amp resistive load.

Commands available at the console are all units on, all units off, unit on, unit off, lamp dim and lamp brighten. All commands may be sent either manually from the console keyboard or under program control. The keyword to send commands to the remote control modules takes the form: ACTL. The various commands have preassigned numbers. These numbers are: unit ON=65, BRIGHTEN=66, ALL LIGHTS ON=67, UNIT OFF=68, DIM=69, and ALL OFF=70.

In many remote control systems, false commands interfere with the remotes. The interference is generally in the form of noise on the AC power line; or, the remotes may accept commands from command consoles in the next apartment or from the house next door. The BSR X 10 system overcomes both these problems.

The command console's 16 position house code select switch prevents interference from other command consoles. Simply set the switch to the house code desired. Each remote control module then must have its house code select switch set to the same house code as the command console.

The command console provides up to 16 separate "channels" of remote control. Each remote control unit incorporates a 16-position unit select code switch, which you set to whatever unit number you want the module to respond to. Note that by setting multiple units to the same unit select code, you can control banks of devices by one unit number.

To turn on the light plugged into a lamp module with unit select code switch set to 4, use the syntax: ACTL4, 65. The command ACTL tells the computer to send a command to one of the remote modules, while the 4 indicates which unit should respond to the command. Finally, the 65 specifies that the unit should be turned on.

To dim a light, use this sequence of commands:

ACTL UNIT NUMBER, 65 (turns on the light plugged into unit number)

FOR X=1 TO 5: ACTL UNIT NUMBER, 69: NEXT X

This last command dims by five steps the light controlled by the module set to unit number.

Setting up the remote control system is a simple process of plugging units together. An RCA phone cable ties the computer into the BSR command console. The console plugs into any standard AC wall socket (the commands actually are transmitted over the AC power lines). The remote control modules plug into standard AC wall sockets; and the lamp or appliance to be controlled plugs into the remote control module — except for the wall switch remote control, which mounts in the wall just like a standard wall switch. The wall switch module has a standard switch so that it may be used as a conventional wall switch.

With the CA-12 96-line parallel I/O board, the AC-12 remote control system provides the following functions:

- 96 lines programmable for input or output
- Real time clock (time of day)
- Count down timer

When set up as outputs, the 96 lines provide TTL level on/off signals. Set up as inputs, each line can be defined as inactive, active closed, or active open circuit. Note that each line may be independently defined as an input or output. If a switch defined as active signals the computer system, the BASIC program currently being executed is halted and a user program is run. The user program determines which switch signaled the computer and then takes the appropriate action.

The time of day is also available. The countdown timer can automatically halt program execution and run a user program upon its timing out.

A wide realm of possible uses for this remote control system spring quickly to mind. But, its real usefulness lies in applications for *your* home.

This continuing series of articles, centered around Ohio Scientific equipment, provides information applicable to many 6502 based systems.

WHAT'S COMING UP

SYSTEMS

Low-cost Personal Computer

Interact Electronics announced that the Model One Benchmark, the "no-frills" version of its Model One Computer, will retail for $449.95.

The Benchmark is one of four variations of Interact's Model One, which includes their top-of-the-line Professional-Plus, as well as the Professional and Standard. All four Model One packages use the same 16K memory processor, but combine different attachments, accessories and program tapes to meet the needs of a variety of consumers, from the complete novice to the more sophisticated personal computer enthusiast, the company said.

The Model One Professional-Plus, priced at $699.95, comes with accessories and attachments for sophisticated computer users. Standard features include a raised keyboard for efficient prolonged programming; a peripheral interface, which allows any standard printer to be attached to the computer to produce paper copy; and a Level II BASIC Program tape. The unit also comes with a set of 12 program tapes from the Interact application library, two entertainment controllers and one data tape.

Model One Professional, which sells for $599.95, has the same standard features of the Professional-Plus, but does not include the peripheral interface. The Model One Standard, priced at $549.95, is similar to the Model One Professional but has a standard height keyboard rather than a raised one.

The Model One Benchmark has a full-size keyboard, a built-in cassette deck, television connector cable and RF switchbox, as do all the other models. The Benchmark unit comes with an Edu-BASIC Program tape rather than a Level II Program tape. Edu-BASIC, a simplified BASIC language, uses regular English to introduce the programming concept, the company said. Peripheral interface, raised keyboard, entertainment controllers and additional program tapes are options for the Model One Benchmark.

For more information contact Interact Electronics, 2548 Packard Rd., Ann Arbor, MI 48104. *Circle 120*

PERIPHERALS

Microstar Disk Capacity Expanded

Micro V Corporation has expanded the disk capacity of its Microstar business computer system to 4.8 megabytes. The additional megabytes are available as an option on four double-sided, double-density floppy disk drives. This new option increases by four times the 1.2 megabytes of storage capacity offered originally.

Microstar, a diskette-based system, is intended for many applications, including small business data systems, accounting, word processing, order entry, inventory and communications and control systems. It features the STARDOS multi-user operating system with BASIC language support and Update, a data management system and report writer.

A complete small business system (with multi-user capability) including a video display terminal, a 1.2 megabyte dual disk drive, 65K byte RAM and 132-column line printer, the computer costs under $10,000. Delivery is off-the-shelf to 30 days ARO.

For more information, contact Micro V Corporation, 17777 S.E. Main Street, Irvine, CA 92714. *Circle 121*

Low-Cost Intelligent Printer

The new Trendcom 100 Intelligent Printer, with 40-column hardcopy on 4-1/2-inch wide paper, features bidirectional 40-character-per-second printing with a full 96-character ASCII set, including upper and lower case letters, numerals and punctuation marks. The 5-by-7 dot-matrix characters are printed with either black or blue images, depending upon the paper used. Interfaces are available for the TRS-80, Apple II, PET and Sorcerer.

According to Trendcom, the quiet printer uses a thick film thermal print head to eliminate wear and reliability problems. The printer, fully enclosed in a metal and high-impact plastic case, is available in both 115 VAC and 230 VAC versions.

The unit is available from stock in retail computer stores and carries a suggested retail of $375. For more information, contact Trendcom, 484 Oakmead Parkway, Sunnyvale, CA 94086; (408) 737-0747. *Circle 122*

Full-Size Floppy for TRS-80

Maxi-Disk, from Parasitic Engineering, is a Shugart 800 based, full-size floppy disk system compatible with existing TRS-80 Mini-drives. It can be mixed and matched with the smaller drives. The system plugs into the TRS-80 expansion interface. The user removes the disk controller chip from the expansion interface and replaces it with a specially designed circuit board. In that circuit board is a socket where the controller chip is re-inserted. All necessary parts and instructions are provided by the company. No soldering or trace cutting is necessary.

The expansion interface can be used as designed, since the only change made is to turn the disk controller from a 5" only controller to an 8" and/or 5" controller, according to the company.

The $995 price includes the 8" drive, the interface board

and a patch to the TRS-DOS that allows the user to access a variety of drives. For more information contact Parasitic Engineering, Box 6314, Albany, CA 94706; (415) 527-6134. *Circle 123*

Miniprinters for Microcomputers

Centronics Data Computer Corp. has announced a seven-member grouping of Model 730 miniprinters designed for professional and small business applications.

Priced from $995, Models 730-1 through 730-7 all offer a three-in-one paper handling system and use the same heavy-duty free-flight print head technology found in all Centronics computer-grade 700 Series printers, said the company.

Of the seven miniprinter Model 730s, two are designed for North America and four for European markets while the seventh unit, with a Katakana character set, will be made available in Japan.

All models include a 50-character-per-second print speed, 80-column line length at 10 characters per inch, a full line buffer, high-speed carriage return and high quality 7 x 7 dot matrix printing.

The Model 730 miniprinters weigh under 10 pounds and measure 14.5 inches wide by less than a foot deep and less than 5 inches tall.

All Model 730s come with built-in ability to handle multi-part plain paper in any one of three operator-selectable ways. The printer's typewriter-like platen takes hand-fed 8-1/2-inch wide sheets in letter size, legal size or longer lengths. Standard international-sized A4 sheets may also be used. Fixed pins on the platen automatically accept standard computer-grade multi-part or single-part fanfold paper 9 inches wide from pin to pin. And, this system also allows the use of 8-1/2-inch wide roll paper up to 5 inches in diameter. A detachable paper holding rack for roll paper is standard.

With the Model 730's paper-handling features, a user can perform various functions — from payroll checks on pre-printed continuous forms and inventory listing on computer-grade fanfold paper to direct mail letters on cut sheets and general information on low-cost roll paper.

The Model's 10-character-per-inch printing capability allows the printer to accept standard forms typically used in demand document applications. Due to the printer's heavy-duty print head, up to three simultaneous copies are possible, making multipart forms processing more practical. And, each unit has a built-in tear bar for paper tear-off within five lines of print.

Other applications for the Model 730 include electronic mail, message logging, technical and scientific data logging and reservation systems.

The North American Model 730-1, a parallel-interfaced

60 hertz unit, costs $995. The other domestic model, the 730-3, is a serial-interfaced 60 hertz unit priced at $1045. Both include a complete upper and lower case 96-character US ASCII set.

The four European models include the 730-2, a parallel-interfaced 50 hertz printer with a 96-character US ASCII set; and the 730-4, a 50 hertz serial-interfaced printer with the same character set. Models 730-5 and 730-6, parallel- and serial-interfaced respectively, offer five switch-selectable European character sets as well as the 96-character US ASCII code. These sets include English (UK), French, German, Italian and Swedish/Danish.

The seventh model, the parallel-interfaced 730-7 with a Katakana character set, operates at 50/60 hertz and 100 volts and is designed for Japanese markets.

For more information contact Centronics, Hudson, NH 03051, (603) 883-0111. *Circle 124*

Solid State Keyboard

A solid state ASCII keyboard using touch-sensitive sensors instead of mechanical keys is available from Tasa, Inc. The Micro Proximity Keyboard is simple to hook up to any computer, the company said.

The thin (0.325-inch), flat, rectangular keyboard has no exposed components, making it durable under extreme conditions, Tasa said. For example, coffee spilled on the keyboard is simply wiped off, with no damage to the keyboard itself. The keyboard also functions in hostile industrial environments involving dust, temperature extremes, moisture, chemicals or radio frequency interference.

Price is $75. For more information contact Tasa, Inc., 2346 Walsh Ave., Santa Clara, CA 95050; (408) 247-2301. *Circle 125*

SOFTWARE

Accounting Programs for Apple II

Charles Mann & Associates' Micro Software Division has released a new series of accounting programs for the Apple II computer. The systems handle small business billing, invoicing and tax problems using Apple's floating point BASIC. The single-purpose systems complement general accounting packages already available, the company said.

Ledger Record System handles small monthly accounts receivable activities. Invoicing system provides for daily order activity including packing and shipping documentation. Billings Management provides elements for both monthly billings and daily invoicing.

Also released were the firm's Tax Management and Inventory Packages. The tax package, a full tax planning element for both individuals and corporations, estimates both income from business activity and the tax consequences from the activity. The inventory package is a full-time system featuring rapid sorting and display of all vendor and item file data. The package is available with an optional statistical element

for demand estimation and order point estimation.

Prices are: Ledger Record System, $69.95; Invoicing, $64.95; Billings Management, $99.95; Tax Management, $94.95; and Inventory, $94.95.

The firm has also made available their new software products catalog supporting Apple II. For more information contact Charles Mann & Associates, Micro Software Division, 1926 South Veteran Avenue, Los Angeles, CA 90025; (213) 473-0244. *Circle 126*

Inventory Control Cash Register for the Apple II

Point of Sale, an inventory control and cash register software package, provides businesses with a means of handling inventory, invoicing, back orders, sales and cash.

While operating much like a simple cash register, the system maintains data on inventory level, reorder points, inventory cost and wholesale and retail value. Sales information may be provided as daily total, and totals by month and year to date. Balance of cash on hand is instantly available. Sales tickets, invoices and purchase orders are automatically generated and vendor and customer files provide for reordering and promotional contact. System documentation includes a step-by-step operator's manual.

Point of Sale is designed for use with Apple II with 48K RAM, dual Disk II drives, Applesoft II firmware card and parallel printer. Retail price is $500 per copy.

For more information contact High Technology, Inc., 1611 Northwest 23rd St., Oklahoma City, OK 73106, (405) 528-8008. *Circle 127*

Airplane Instrument Simulator

Aircraft Instrument Simulator creates a real-time, high resolution, color graphics simulation, with engine sound effects, of an aircraft instrument panel which realistically responds to input from the keyboard and playing paddles.

The aircraft instruments appear on the screen and respond smoothly, in real-time, to the keyboard and game paddles to control the simulated airplane, said the company. The instruments display attitude, airspeed, altitude, rate of climb and descent, compass heading and rate of turn of the aircraft.

The program, written in both integer BASIC and machine language, is designed to run on a standard Apple II computer with at least 16K of memory.

Price for the simulation with tape and instructions is $8.95. For more information contact Soft-One, 315 Dominion Dr., Newport News, VA 23602. *Circle 130*

Apartment Complex Management Program

A new apartment complex management program for TRS-80 and Micropolis Mod II systems includes extensive documentation and a user's guide written for non-programmers.

Functions include listing transactions, posting rents, listing vacated tenants, tabulation of all transactions, vacancy listing, delinquent tenant listing and mailing labels.

Price is $150. For more information contact Honest John's Software, 8929 Cardinal Terrace, Brentwood, MO 64144.

SOFTWARE

CP/M Users Gain Keyed File Support

Micro Applications Group has introduced MAGSAM, a keyed file management system designed for the CP/M operating system.

MAGSAM enables users of CP/M and CBASIC to create and access data records quickly and directly by user defined keys, said the company. Records may be retrieved randomly by key, sequentially by key, generically by key (wild card search), sequentially in physical (chronological) order, and randomly by relative record number. Records may be created randomly by key and sequentially by key, and updated by any of the retrieval methods. Optional features include support for multiple data paths through the use of multiple keys and secondary indexes, and real-time record and key delete capability with automatic reclamation of free space.

Three versions of MAGSAM are available to meet various requirements. MAGSAM III, the most advanced version, supports multiple keys, secondary indexing and full delete capability. MAGSAM II is a single key implementation with full delete support. MAGSAM I, the entry level version, supports single key file structures with deletes performed by file reorganization.

MAGSAM runs as a subroutine to CBASIC programs and requires 6K of memory over that occupied by the operating system and the calling program. All versions are available on standard 8", Micropolis, and TRS-80 diskette formats in source form. A single site license for MAGSAM III is $145; MAGSAM II is $99; and MAGSAM I is $75. Each package includes the file manager, tutorial program, file dump utility, User Guide, Reference Card and one year update service. The User Guide is available separately for $15. For more information contact Micro Applications Group, 7300 Caldus Avenue, Van Nuys, CA 91406; (213) 881-8076. *Circle 151*

North Star Disk Operating System Extension

Interactive Microware, Inc., has added a North Star Disk Operating System Extension, DOS+, to its software package library. DOS+ enables any program to execute all North Star Disk and/or Meca Tape commands, either individually or in combination, said the company. DOS+ also provides a simple protocol for transfer of ASCII data between programs and I/O devices.

DOS+ allows BASIC programs to list the directory, create

or delete disk files, initialize diskettes and execute all other operating system commands. It also works with assembler language programs or high level languages that use DOS routines for character input and output. With DOS+, any program can create a list of operations in memory and then execute them once, or repeatedly. The list of commands can be passed on to other programs.

DOS+ requires no changes in DOS or present I/O routines, and it runs in less than 1K bytes of memory. DOS+ is available for immediate delivery and comes with manual and North Star diskette for $35 (source code not included). For additional information, contact Interactive Microware, Inc., P.O. Box 771, State College, PA 16801. *Circle 152*

CIS COBOL for North Star Systems

Micro Focus can now supply their Version 3 CIS COBOL compiler for use with microcomputers employing the North Star disk system and running the Lifeboat Associates version of the CP/M operating system.

North Star users can now write programs in a standard structured language on low-cost hardware. CIS COBOL for North Star is supplied on two mini floppy disks; one contains the compiler and run-time system and the second contains the utilities CONFIG and FORMS in addition to some demonstration programs. CONFIG modifies the run-time system according to CRT requirements, while FORMS allows keyboard creation of forms for data input and output on the CRT.

For more information contact Micro Focus, Ltd., 58 Acacia Road, St. John's Wood, London, England NW8 6AG. *Circle 153*

New formats for 8080/Z80 Disk Software Line

Lifeboat Associates has made available its 8080/Z80 disk software line on four new formats: the North Star Double Density, Processor Technology Helios II, MITS Altair hard sector and Ohio Scientific C-3 disk systems. Formats previously implemented and still supported include North Star Single Density, Micropolis, iCOM, SD Systems, Dynabyte DB 8/2 and 8″ IBM. Other formats are available on request. Lifeboat also plans to release a series of software modified for the Heath H8/H17.

All Lifeboat software runs with the CP/M operating system, supplied either as original equipment by the computer manufacturer or by Lifeboat at $145. The basic package includes text editor, assemblers, debugger and various other system utilities.

For more information contact Lifeboat Associates, 2248 Broadway, New York, NY 10024. *Circle 154*

Business Software for 8080, Z80

California Microcomputer Company, Inc., has released business software for use with 8080 or Z-80 based CP/M microcomputer systems.

The Calmicro business package includes: General Ledger with user-formatted Income Statement and Balance Sheets; Accounts Receivable, either open item or balance forward; Accounts Payable, including mailing labels and check printer; and Payroll with W-2 and check printing.

Equipment requirements for the software package are 48K of memory, CP/M or Forte, a terminal, a 132-column printer and a dual 8'' standard floppy disk system running on Altos, Micro-2 or Equinox 100 user systems.

The package, including programs and complete user documentation, is available for immediate delivery. User manuals can be ordered for $15/manual, C.O.D. Please specify manual. For further information contact California Microcomputer Company, Inc., P.O. Box 3199, Chico, CA 95927; (916) 891-1420. *Circle 128*

8080 Simulator for Apple

Dann McCreary has announced Apple-80, an 8080 simulator which allows any 16K or larger Apple II to run programs written for the 8080. The package can be used as a design and debugging aid for the development of original 8080 software.

Apple-80 provides single-step, trace and run modes and executes all valid 8080 op-codes. Illegal op-codes are rejected. All 8080 registers are visible on the Apple screen and may be modified at will. 8080 I/O port addresses are arranged in a table for ease of user modification. Up to 8 breakpoints may be set to facilitate program debugging. 6502 subroutines may be called directly from 8080 programs, allowing full access to Apple monitor and user-written functions. Conversely, 8080 routines may be embedded in 6502 programs. Vectored interrupts are also simulated.

The complete Apple-80 package includes Apple-80, Apple-80 Manual, an 8080 program which demonstrates Apple-80 features and an Apple-80 Ready Reference Card. Price is $20 plus $1.50 shipping and handling. For more information contact Dann McCreary, Box 16435-T, San Diego, CA 92116. *Circle 156*

General Ledger System Software

Percom Data Company has announced a low-cost accounting/bookkeeping software system for 6800 microcomputers. Called Percom General Ledger System, the programs run on computers using the company's LFD-400 dual-drive minidisk storage device.

Developed by a Certified Public Accountant, the Percom GLS may be operated with little or no knowledge of bookkeeping. Moreover, the business owner needs only a superficial knowledge of computers, said the company.

Features of the Percom General Ledger System include:

- Efficient operation: Account balances are updated immediately in real time — time-consuming sorting/posting data processing is unnecessary. Financial statements may be printed immediately after journal entries.
- Adaptability: User selects and assigns own account numbers, and formats financial statements tailored to firm's particular requirements.
- Easy-to-use: The GLS programs guide the operator throughout an application by prompting for user response with characters and non-technical questions.
- Error detection: The GLS signals the operator if journal entries do not balance. Invalid account numbers are rejected.
- Audit trail: A posting analysis report program provides a complete audit trail to source documents.

The Percom General Ledger System accommodates up to 250 accounts. The General Ledger System runs under Percom's Super BASIC, and the two programs together require 24K bytes of RAM.

Minimum hardware required, in addition to a 6800 computer and LFD-400 drive system, is a CRT console such as the Lear-Siegler ADM-3 and a line printer capable of printing on 8 1/2 × 11 inch paper.

The Percom General Ledger System software is supplied on mini-diskette along with a user's manual for $199.95. The disks and manual may be ordered by dialing Percom's toll-free ordering number: 1-800-527-1592. For more information contact Percom Data Co., 211 N. Kirby, Garland, TX 75042; (214) 272-3421. *Circle 157*

Bowling League Software and Other Programs

Several programs, including a bowling league statistics program, home accounting system and a North Star BASIC cross-reference program, are available from Dieter Kaetel of Mercer Island, WA. In addition, Kaetel offers a North Star BASIC to CBASIC-2 conversion service.

With the bowling program, appropriate standings and statistics reports are produced. The system features "plain English" data entry prompting with extensive editing, said the company. Two versions of the system are available. Version A, customized for a single league, costs $35. Version B is intended for multi-league service bureaus and/or direct entry and use by the bowling establishment and league staff. Price is $295.

The system is available on 5" or 8" diskettes written in North Star BASIC or CBASIC-2.

The cross-reference program produces a sorted listing of all variables and GOTO/GOSUB references and their usage type. Price is $18.78 on diskette.

The home accounting system is a collection of related programs to keep track of all paid and projected expenses and income. Features include user-defined English-language account categories and extensive user documentation with sample files and reports. Price is $18.78 on diskette.

The North Star BASIC to CBASIC-2 conversion (and vice-versa) service converts source programs from one to the other as well as from 5" to 8" (and back) disk media, said the company. No copies of the programs are kept and a non-disclosure statement is signed. The hobbyist rate is 10 cents per source program line or 3 times the retail price if the programs are for sale. Commercial rate is 1 cent per source code character with a 3 times retail price minimum.

For more information contact Dieter Kaetel, 7201 87th Ave. SE, Mercer Island, WA 98040. *Circle 158*

Software Club

Creative Discount Software has announced a new Software of the Month Club. The service, according to founder Pat Masterson, is an extension of the firm's other large volume software distribution programs.

The club will have separate branches for users of the Apple II, TRS-80, Ohio Scientific, Exidy, Pet and CP/M based systems.

Contact Creative Discount Software, Software of the Month Department, P. O. Box 24-B-67, Los Angeles, CA 90024. *Circle 131*

Apple II Disassembler

Microproducts announced a two-pass disassembler for Apple II users who want to debug, modify, analyze and understand the functions and operation of inadequately documented programs.

This programming tool disassembles any machine language program which resides in the Apple II, such as BASIC or the Disk Operating System and printer driver routines.

The disassembler is available, with instructions, on cassette for $29.95, and on diskette for $33.95. California residents add 6% sales tax. For more information contact Microproducts, 2107 Artesia Blvd., Redondo Beach, CA 90278; (213) 374-1637. *Circle 159*

TRS-80 Finance Package

Finance-I, a personal finance package for the TRS-80, consists of two programs: Bank-I for check balancing; and Stock-I, a stock security information system.

Bank-I saves and restores the data base to and from a data cassette, produces reports and allows the user to modify the data base. A transaction code is used to describe the transaction (tax expense, medical expense or deposit, etc.). A subtotal for each expense or deposit is given at the end of the report.

Stock-I lets you keep track of your stock holdings and your net worth. After you enter the day's stock once, the program gives you a summary of that stock, including original cost, market value, profit with/without dividends, annual rate of return and holding period. After you enter all the current prices for your stocks, two reports will be produced.

The package requires a Level I or Level II 4K system. Price is $10 each or $15 for both programs. For more information contact Micro Architect, 96 Dothan St., Arlington, MA 02174. *Circle 129*

Software for UCSD Pascal

Pickles & Trout offers two software packages for the UCSD Pascal operating system.

The first package, Formout, is a collection of routines to do formatted output from Pascal programs. Formout relieves the programmer of the burden of creating routines to make the pretty output he wants from his program. Included routines allow formatted printing of strings and numbers, tabbing to a specific column and printing an arbitrary number of spaces or other printing characters. Formout allows the user to easily switch from one I/O device to another so that programs can be debugged using console output and run using the printer, or output can be switched between devices on the fly.

CPMREAD translates CP/M disk files to Pascal test files. It allows the user to investigate the CP/M disk directory and choose the files to be translated. Assembler and BASIC source code can be brought across and then modified for use on the Pascal system using the standard Pascal editors. Since CPMREAD is written completely in Pascal, it can run on any machine running in the UCSD Pascal system, allowing LSI-11 (and other) systems to have access to CP/M files.

Formout is available as a source listing with manual for $20. A machine-readable copy of Formout is available on 8-inch soft-sectored, single-density diskette for an additional $10. CPMREAD, distributed as an executable code file only, costs $25.

For further details contact Pickles & Trout, P.O. Box 1206, Goleta, CA 93017; (805) 967-9563. *Circle 181*

BASIC Enhancement

LABEL-BASIC, a new language from Smoke Signal Broadcasting, acts as a pre-processor to translate programs written in LABEL-BASIC into programs utilizing a BASIC interpreter or compiler. As an extension of most versions of BASIC, it also provides descriptive line labels and variable names.

Because line numbers can be matched, programs may be built from a library of LABEL-BASIC subroutines by appending previously-tested subroutine files to the main program file. The procedure is similar to loading Fortran subroutines from a system library, although using an editor at source code level is not required.

LABEL-BASIC, available on all 6800-based Chieftain microcomputers and SSB disk systems, costs $59.95. For further information contact Ric Hammond, Smoke Signal Broadcasting, 31336 Via Colinas, Westlake Village, CA 91361, (213) 889-9340. *Circle 182*

6800 Software

Percom Data Company has announced six new 6800 programs: an assembler-linking loader, three disassemblers, a relocator and a monitor with debugging conveniences.

The programs, developed by Ed Smith's Software Works, are available on either cassette or disk, except the monitor which is in EPROM. Cassettes are Kansas City Standard format at 300 baud. The programs work with Percom operating systems.

The programs may be ordered by dialing Percom's toll-free number: (800) 527-1592. Check, money order, Visa and Master Charge are accepted. Texas residents add 5% sales tax.

Prices are: $55.95 for relocating assembler and linking loader; disassembler and segmented source code text generator, $30 tape, $40.95 disk; disassembler/source generator, $25 tape, $30.95 disk; disassembler/trace, $20 tape, $25.95 disk; relocator, $20 tape, $25.95 disk; monitor, $70. For more information contact Percom, 211 N. Kirby, Garland, TX 75042. (214) 272-3421. *Circle 184*

Micros Become Intelligent/Memory Typewriters With New BASIC Software

Most micro systems can now do double duty as intelligent or memory typewriters with a new software family written in 8K BASIC, according to Monoson Microsystems. Called Capdoc — Computer Assisted Preparation of Documents — the company's first package of the series is available for a single user license fee of $34.95.

The software features ease of operator training, word wrap, justification, centering, underlining, merging of text, boldface, proportional spacing and dual column printout, as well as magnetic storage and full-screen display. Small business computers, shared logic stations and hobbyist systems such as Radio Shack, Apple and Ohio Scientific can become useful general office equipment using Capdoc, the compay said.

Capdoc also provides automatic page numbering and headings, and the documentation shows how to combine Capdoc with subroutines to develop short, task-specific programs such as filling in forms, preparing mailing lists or generating envelopes.

Operator prompts at logical points in the preparation of a document reduce the number of operator commands to a handful of single-stroke symbols. The system does not require the use of function, escape or control keys making it virtually universal, according to the company.

The current package consists of Capdoc/Intelligent Typewriter, Capdoc/Memory Tyepwriter and Diablo Printout Guide.

For more information contact Monoson Microsystems, Inc., P.O. Box 97-L, Watertown, MA 02172. *Circle 185*

Password Security Feature for North Star Users

A password security feature is available to North Star users from HSC Computer Services. Comparable to the large computer system feature, the password allows authorized access to your disks since each disk may have a different password up to 23 characters long.

The package, on mini-disk, contains a modified NS DOS, modified NS BASIC to suppport the password feature, a BASIC program to allow changing passwords, and a BASIC file with easy-to-use instructions. The $32 diskette is available from stock. The company accepts check, money order, Master Charge and Visa. Contact HSC Computer Services, Ltd., P.O. Box 43, Brooklyn, NY 11236; (212) 780-0022. *Circle 186*

WANTED:

BUSINESS PROGRAMS

Personal Computing readers want your business applications programs. Chances are, the software you've developed to solve your business problems will also help someone else faced with a similar problem.

Consider how your business benefits from your microcomputer — not only in the obvious areas of inventory, accounting and payroll, but in all departments and levels right up to the president's desk. Financial and marketing analysis, time management, planning, materials handling, product design and cost accounting are areas ripe for creative programming. Readers want help with all of these problems.

So why not share your solutions with our readers? Send us an article describing the problem you faced and how you used your microcomputer to solve it. Be sure to include a program description, program listing and sample run.

Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

All submissions should be original, typed (not all CAPS), double-spaced and neat. Include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material. Also, please use a fresh ribbon on your printer for program listings and sample runs.

Feel free to call us at (617) 232-5470 if you have any questions or want to discuss specific article ideas.

Mail your manuscript to:

Editor
Personal Computing
1050 Commonwealth Ave.
Boston, MA 02215

TRS-80 Financial and Statistics Software

Six new financial packages and five statistics packages for TRS-80 computers are available from National Software Marketing.

Finance Pack-1 contains three programs. The first computes bond interest for earned interest and for yield to maturity. The second program computes effective interest rates. The third computes true interest rates on an installment account. This package sells for $12.95.

Finance Pack-3 has three modules. The first computes and prints mortgage amortization. The second analyzes and compares different mortgages. The third computes and prints present and future values. This package lists for $9.95.

Finance Pack-5, which lists for $12.95, analyzes stock purchases, considering such factors as market growth, market share and sales price.

Finance Pack-7, with two modules, calculates the effects of bond switching on the portfolio, and also calculates stock value for the capital investment based on an analysis of dividends. This package lists for $12.95.

Finance Pack-9 and Finance Pack-10 are both menu driven programs. Pack-9 calculates compound interest, annuities, amount of mortgage payments, loan balances, present values, future values and periodic withdrawal plans. Pack-10 calculates mortgage amortization schedules, depreciation, averages, retail mark-up and annual interest of a cash discount. Both list for $22.

The price of each Finance Pack includes shipping and handling.

Statistics Pack-1 has two modules. The first, Linear Regression, reads a distribution of paired X-Y values provided by the user. The output contains the paired values mean of x and mean of y, the standard deviation of x and y, and an expected value of y for any given x. The other module, Correlation, reads in pair x-y values provided by the user. The output contains paired values, correlation coefficient, observation count, mean variance and standard deviation of x and y.

Statistics Pack-2 reads a distribution of paired X-Y values supplied by the user. It calculates expected values and outputs the Chi-Square value and Degree of Freedom. Both observed and expected value matrices are displayed.

Statistics Pack-3 reads in a user distribution and produces for each value its Z score equivalent sorted in ascending order. Also printed is the sum of squares, variance, median, standard deviation and skewness. This package also contains a program that accepts a distribution of paired values and produces a horizontal histogram.

Statistics Pack-4 calculates Chi-Square, slope for linear regression, mean, variance, standard deviation, and T-Ratio for two groups of unpaired data.

Statistics Pack-5 computes multiple linear regression, calculates variance tables for analysis of Greco-Latin square and calculates F ratio for Youden square design.

Statistics Packs-1, -2 and -3 are available for $12.95. Statistics Packs-4 and -5 cost $12.

Contact M. Scott Kleiman, National Software Marketing, Inc., 4701 McKinley Street, Hollywood, Florida 33021; (305) 625-6062. *Circle 187*

Software for Graphic Tablet

Talos Systems, Inc., has developed application software for its Digi-kit-izer graphic tablet, including seven programs written in Applesoft BASIC for the Apple II computer.

In addition to X-Y coordinate location output, the user can have his own computer-aided design system by capturing, moving and rotating preprogrammed logic symbols to construct circuit diagrams. Tracing curves or polygons allows calculations of both perimeter and areas of these irregular shapes.

Other programs in the package include music generation by pen location, Hires graphics and Lores color graphics, each brought up by simply touching the menu selection area of the Digi-kit-izer.

Price is $49.95. For more information contact Talos Systems, Inc., 7419 East Helm Drive, Scottsdale, AZ 85260; (602) 948-6540. *Circle 188*

CBASIC Language

Version 2 of CBASIC, a language useful for writing business software, has been announced by Software Systems. CBASIC is a comprehensive commercially oriented compiler/interpreter designed for use with the CP/M operating system.

CBASIC-2 improves on the original version by adding integer variables, chaining with common variables, multiple line functions and a Cross Reference Lister for program variables. Intermediate files are smaller and execution is faster, the company said.

For business applications, CBASIC emphasizes modular design, maintainability, expanded control structures and source code security.

For more information contact Software Systems, P.O. Box 145, Sierra Madre, CA 91024. *Circle 189*

Forth Programming Language

Forth is a programmer's language adapted by Programma International for use with several microcomputer systems. Available are versions for Apple II, PET, Southwest Technical Products, Sphere and TRS-80. Forth requires 6K memory and can be placed in ROM if desired. Also, processing time is shorter than with many other languages.

The basic element of Forth is a word, comparable to a subroutine, which is drawn from words already defined in the Forth System's dictionary. A vocabulary of 200 words makes up the Forth Dictionary. New words drawn from the vocabulary can be user-defined, and may then be used to define more complex functions.

Other features include an incremental assembler, compiler and interpreter, and text editor.

Forth object code is supplied on cassette with preliminary user's manual for $35 plus postage. It is also available on diskette for the Apple II, priced under $50. For more information contact Programma International, Inc., 3400 Wilshire Blvd., Los Angeles, CA 90010; (213) 384-0579. *Circle 190*

TRS-80 Entertainment Software

The Software Association announced a new line of machine language entertainment programs for the Radio Shack TRS-80.

Initial offerings include:

Z-Chess, a full-featured chess opponent providing seven levels of difficulty, from "Blitz" to "Expert." Six moves of "look ahead" are possible. Numbered squares and a board setup mode are provided for ease of play.

Back-40, a backgammon challenger with graphic board display. "Doubling" is permitted, and every feature of a regulation backgammon match is provided, including the score.

Dr.Chips, a program based on the "Doctor" and "Eliza" programs. Machine language allows Dr.Chips to analyze your sentences and talk back to you instantly.

All programs require a 16K Level II machine. Z-Chess is priced at $17.95; Back-40 and Dr.Chips at $14.95 each. For more information contact The Software Association, P.O. Box 58365, Houston, TX 77058. *Circle 191*

Apple Advertising Software

Three new programs allow Apple computers to be used as automated advertising machines to promote products at indoor locations such as stores, hotels and trade shows.

The first program, "The Scrolling Wonder," allows four brief flashing slogans to pop up randomly from the bottom of the screen.

The second program, "Giant Letters," flashes brilliantly colored, full-screen sized letters on the screen until a message is spelled out. A running summary of the message is presented in standard Apple characters beneath the giant letters to help viewers keep track of the letter-sequence.

The third program, "Hi-Res Alphanumeric Message," allows four lines of crisp characters, 28/line, each character 1/8 screen height to be "puffed" on at comfortable reading speed, to form a message. When four lines are filled, a page dissolve occurs and another page can be filled.

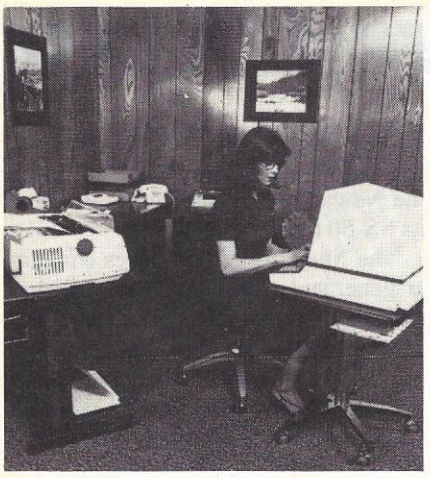
All three programs are available for $25 prepaid. For more information contact Connecticut Information Systems Co., 218 Huntington Rd., Bridgeport, CT 06608; *Circle 192*

COMPLEMENTS

Computer Terminal Furniture

A line of preassembled computer terminal stands that conserve space and blend with office decor is available from the Maine Manufacturing Co.

The Data-Mate Series features detachable baskets that keep input and output data sheets separated while min-



imizing desk space. Accommodating R-0, KSR and CRT terminals, each stand consists of a rugged, unitized welded steel base with a durable 24'' by 24'' simulated wood grain plastic laminated top, said the company. A full line of stands is also available for Centronics printers.

The series is unit priced from $175 to $225, depending on model. Literature is available on request. For more information contact The Maine Manufacturing Company, Industrial Products Division, 46 Bridge St., Nashua, NH 03060; (603) 883-5142; 1-800-258-1678. *Circle 193*

Lower Case for Apple

Dan Paymar's Lower Case Adaptor (LCA) for the Apple enables ASCII lower case letters in string variables to be displayed on the screen.

Features of the LCA include:

- Plugs in with no modifications to the Apple. Easily removed if warranty service is needed for either the Apple or the LCA.
- Displays lower case letters with descenders.
- Includes various special symbols.
- Includes sample software for use with either Apple's Integer BASIC or Applesoft II.
- No memory overhead as with firmware and software methods that utilize the Apple's hi-res mode.
- Fully compatible with Apple's Disk-II DOS.
- Compatible with at least two text editors available from Applecations Unlimited and Programma.
- Compatible with most printers that have lower case.
- Fully assembled and tested on glass-epoxy PC board.
- One full year repair or replace warranty.

The Lower Case Adapter does not interfere with existing features of the Apple nor with standard Apple software or firmware, said the company. There is no overhead in RAM other than a small routine to allow lower case keyboard entry, and no time overhead.

Suggested retail price is $49.95. For more information contact Dan Paymar, P. O. Box A-133, C. S. 6800, Costa Mesa, CA 92627; (714) 645-1411 after 6:30 p.m. Pacific time or weekends. *Circle 194*

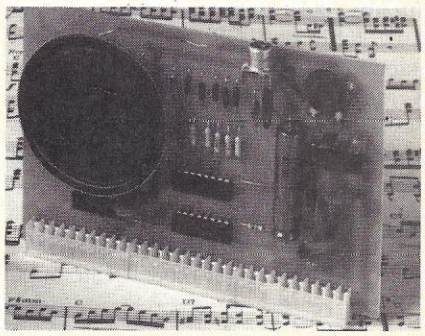
WHAT'S COMING UP

P.C. BOARDS

Music Board for SS-50 Bus

Percom Data Company has added the Newtech model 68 Music Board to its SS-50 bus product line.

The Music Board produces computer-generated sounds such as melodies and rhythms, computer game sound effects, Morse Code sounds, audible prompts for interactive computer operation, train sounds for model railroading, play-along/sing-along music and sounds for other applications.



The board uses one I/O slot of the Southwest Technical Products' 6800 computer, and is supplied with a comprehensive user's manual that includes a theory of operation, a BASIC program for writing music scores and an assembly language routine for program execution.

The card includes address decoding, D/A conversion, audio amplification circuits and its own speaker. The audio circuit includes a volume control. An auxiliary jack for connecting the output audio to a remote speaker or audio system is mounted at the top of the card.

The cassette version of Americana Plus is compatible with Percom's CIS-30+ cassette/data terminal interface unit and the SWTP AC-30 unit. The disk version runs on Percom's LFD-400 system using MINIDOS-PLUSX. The Americana Plus programs, in machine language, do not require an assembler or interpreter program.

The Music Board sells for $59.95 assembled and tested. The cassette version of Americana Plus (MC-1SW) is priced at $15.95. The disk version (MD-1PC) is $19.95.

Orders may be placed by dialing Percom's toll-free number, 1-800-527-1592, and may be paid by check,

money order, Visa or Master Charge. Texas residents add 5% sales tax. For more information contact Percom Data Company, 211 N. Kirby, Garland, TX 75042; (214) 272-3421. *Circle 195*

LITERATURE

Computer for Business People

DDC Publications announced a new book for people planning to buy a business computer system. The book, titled *Winning the Computer Game* by Chris Kloek, presents a business computer guide for the layman or professional.

The book recommends when a company should not computerize, when it should, how to buy systems and services and how to live happily with them, said the company.

Winning the Computer Game discusses custom versus packaged software, contract negotiation, installation management and financing alternatives. Cautions are also provided.

The 178-page guide costs $12.95 (Master Charge and Visa accepted). A 30-day return privilege is provided. For more information contact DDC Publications, 5386 Hollister Ave., Santa Barbara, CA 93111. *Circle 196*

Desktop Computer Guide

A *Correlation Guide to Desktop Computer Selection* from Atlantic Analysis Corporation identifies hardware/software characteristics of over a dozen popular desktop computers, provides a reference for comparing various portable desktop system capabilities, and serves as a basis for determining systems compatibility to aid in the development of more flexible, transportable software. The guide includes a general description of each manufacturer's product line and comparisons with the system lines offered by competitors.

Systems described in detail include the TRS-80, Apple II, IBM 5110 and the Hewlett-Packard 9800, Tektronix 4050 and Wang 2200 series desktop computers.

Two matrices compare system capabilities: one compares hardware characteristics; the other provides an extensive software comparison of over two hundred BASIC language statements. Both matrices provide a space in each category allowing the user to enter characteristics of any system not described in the *Guide*. An explanation is provided on how to use the matrices, characteristics of interest, and a listing of the capabilities to be considered relative to the user's business, scientific and real-time process control needs. A glossary of hardware and software terms and characteristics used in the matrices is also provided.

The guide costs $14.95. For more information contact Atlantic Analysis Corporation, 5 Koger Executive Center, Suite 219, Norfolk, VA 23502; (804) 461-1980. *Circle 197*

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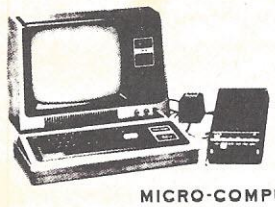

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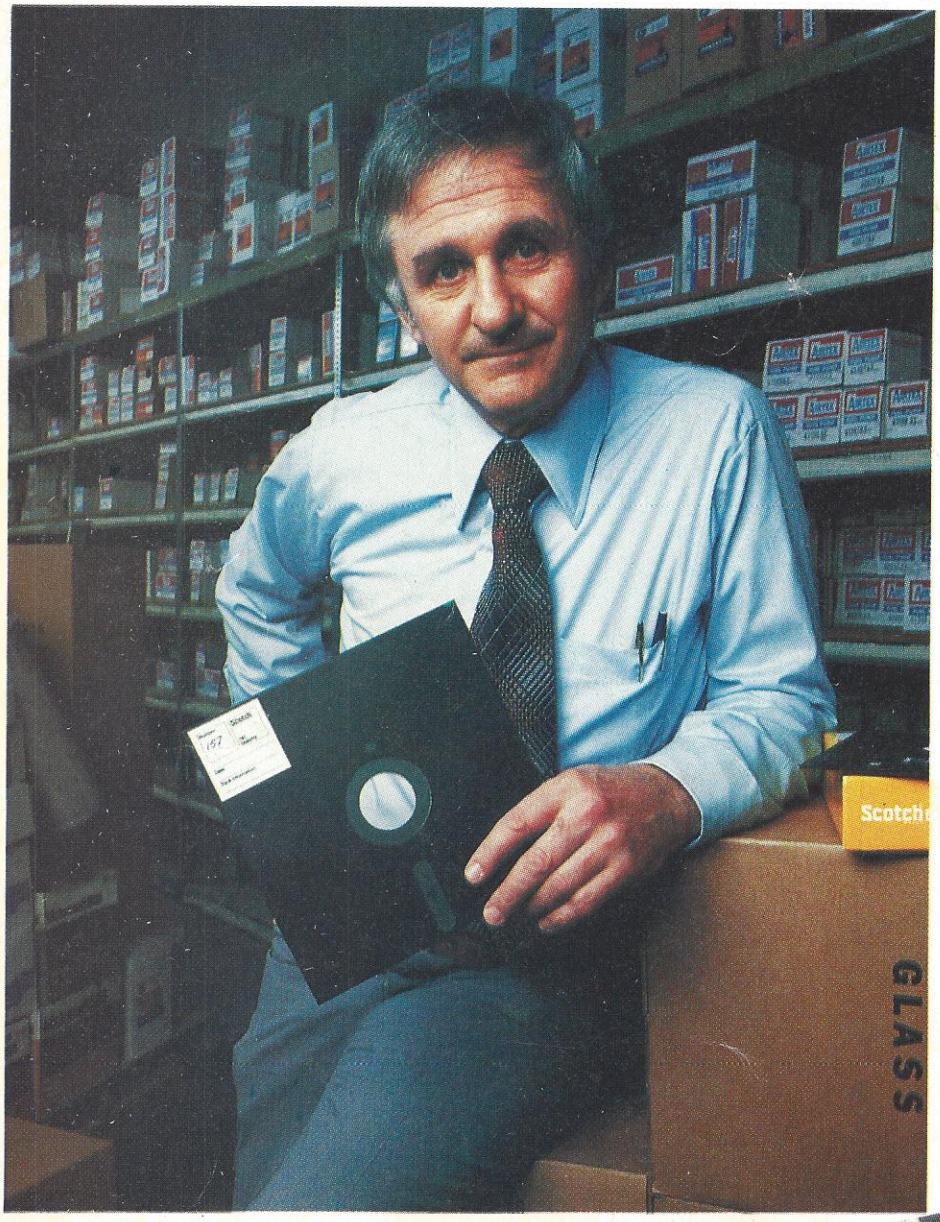

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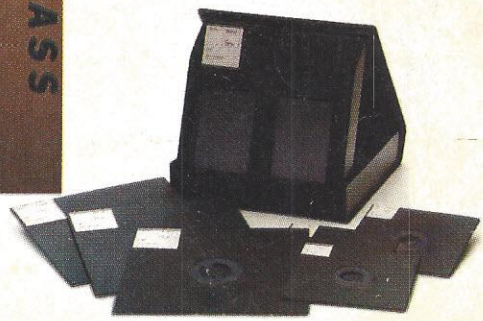

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